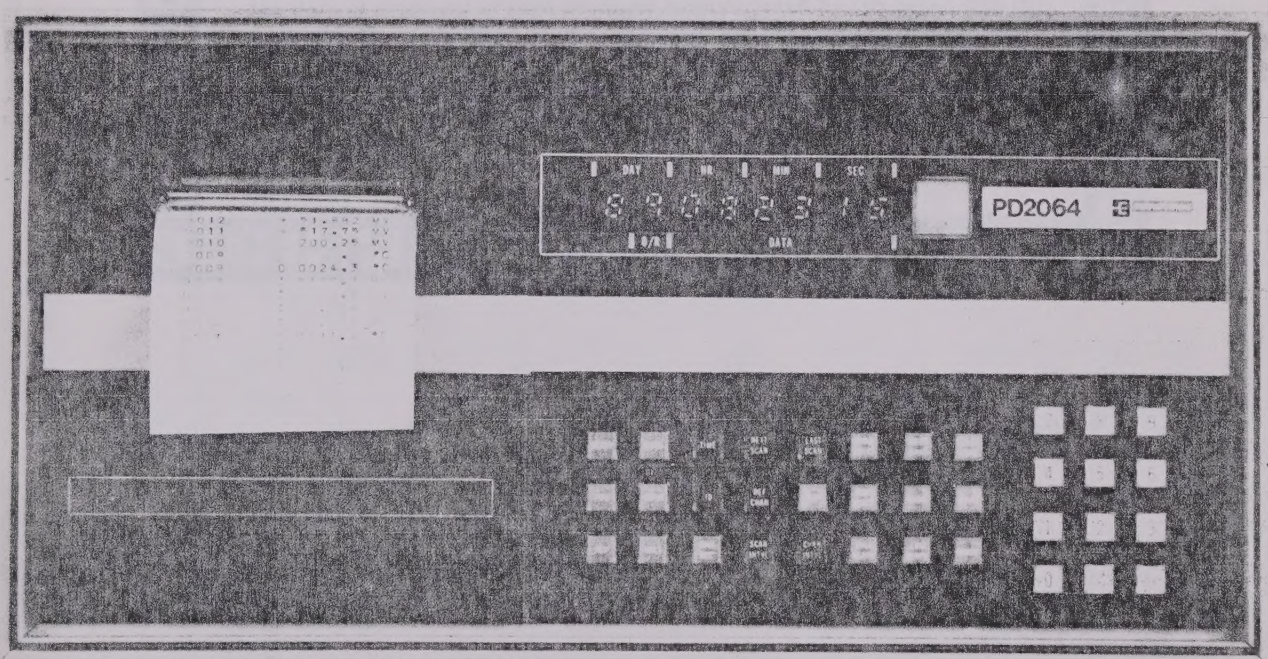
ESTERLINE ANGUS

PD 2064

Key Programmable Data Acquisition System

INSTRUCTION MANUAL
FOR MODEL PD-2064
KEY PROGRAMMABLE
DATA ACQUISITION SYSTEM



P1478A

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M734R1-1
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GENERAL INFORMATION

GENERAL
INFORMATION

PD-2064 SYSTEM CONFIGURATION FOR INSTRUMENT SERIAL NO.

THE FOLLOWING TABLE LISTS THE SELECTABLE OPTIONS AND FEATURES WHICH MAY BE INCLUDED AS PART OF YOUR PD-2064 SYSTEM CONFIGURATION. INCLUSION OF A PARTICULAR OPTION OR FEATURE THAT WAS SPECIFIED AT TIME OF ORDER IS INDICATED BY A CHECK MARK (✓). FOR A COMPLETE TECHNICAL DESCRIPTION OF YOUR SPECIFIC INSTRUMENT, SEE THE DATA SHEET WHICH IS SUPPLIED IN A SEPARATE ENVELOPE AT THE BACK OF THIS MANUAL. SPECIAL DRAWINGS AND SUPPLEMENTARY INSTRUCTIONS THAT MAY BE REQUIRED WILL BE LISTED ON THE DATA SHEET AND WILL BE FOUND IN SECTION G OF THIS MANUAL. FOR LATEST PRODUCTION CHANGES AND CORRECTION NOTICES, REFER TO SECTION H OF THIS MANUAL.

TABLE OF SELECTABLE FEATURES AND OPTIONS

✓ INDICATES ORDERED ITEM	DESCRIPTION	DESCRIBED IN MANUAL SECTION*
	PROGRAMMING OPTIONS	
	Channel Pair Programming	A
	Single Channel Programming	A
	"Alarm Setpoints" Custom Program Initialization	3
	"System" Custom Program Initialization	3
	Program Bank	D •
	INPUT/MEASURING OPTIONS	
	Auto Ranging	D
	Digital Averaging	D
	Digital Inputs	2 and C
	Digital Smoothing Filter	D
	Keyboard Data Entry	D
	Integrator	C
	Integrator Dual-Rate Reset/Output	C
	Internal Voltage Reference Source	D
	Thermocouple Inputs	2 and C
	OUTPUT OPTIONS	
	"Seiko" Digital Printer Interface	B
	Paper Tape Perforator Interface	B
	Magnetic Tape Recorder Interface	B
	Teletypewriter Interface	B
	RS-232-C Data Communications Interface	B
	Dual-Rate Output	D
	Out-of-Paper Printer Disable	B

✓ INDICATES ORDERED ITEM	DESCRIPTION	DESCRIBED IN MANUAL SECTION*
	ALARM OPTIONS	
	Alarms (For "Class A" Alarm Setpoints--Assignable Only to Fixed Channels in System)	3 and G
	Alarms (For "Class B" Alarm Setpoints--Assignable to Any Channel in System)	3 and G
	Alarm Relay Outputs (For "Class A" Alarm Setpoints--Assignable Only to Fixed Channels in System)	B
	Alarm Relay Outputs (For "Class B" Alarm Setpoints--Assignable to Any Channel in System)	B
	Print-On-Alarm	3
	Print-Only-On Change-of-Alarm Status	3
	MISCELLANEOUS OPTIONS	
	Expander Box(es)	D and/or G
	Memory Save	1 and 3
	One-Thousand Day Clock	D
	Power Line Filter	F**
	Remote Control Connector	D
	Remote Keyboard and Display	D •
	Special Units Program	D
	System Constant Printout (Program Printout)	3
	System Scan and Display	D
	CASE OPTIONS	
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	Carrying Handles	2
	Keylock	D
	Rack Adapter	2
	Rack Adapter With Slides	2
	SPECIAL CUSTOM MODIFICATIONS	G

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**Wiring connections shown on drawing #734R4 in "Section F" of Appendix.

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SECTION 1 - INTRODUCTION

1.1 GENERAL DESCRIPTION

a. The Model PD-2064 is a key-programmable data acquisition system under the control of a tiny microprocessor. The system can gather analog and digital (optional) data from up to a total of 248 channels (analog plus digital). The system outputs the measured values in engineering or scientific units through various optional output devices that are described in "Section B" of the Appendix.

b. The Model PD-2064 design is achieved through use of the latest in proven state of the art technology. The solid-state integrated circuit microprocessor is combined with RAMs (random access memory devices), ROMs (read-only memory devices), and PROMs (programmable ROMs) to provide a keyboard-programmable system that permits the instrument to scan, measure, collect, identify, and record both analog and digital input signals.

> NOTE: Refer to "Operation" section in manual for keyboard programming functions.

c. The major functional elements that comprise the Model PD-2064 are shown in the block diagram of Figure 1-1. Major chassis components are modular-constructed, and virtually all chassis wiring is done by flat-wire interconnecting cabling as shown in Figure 1-2.

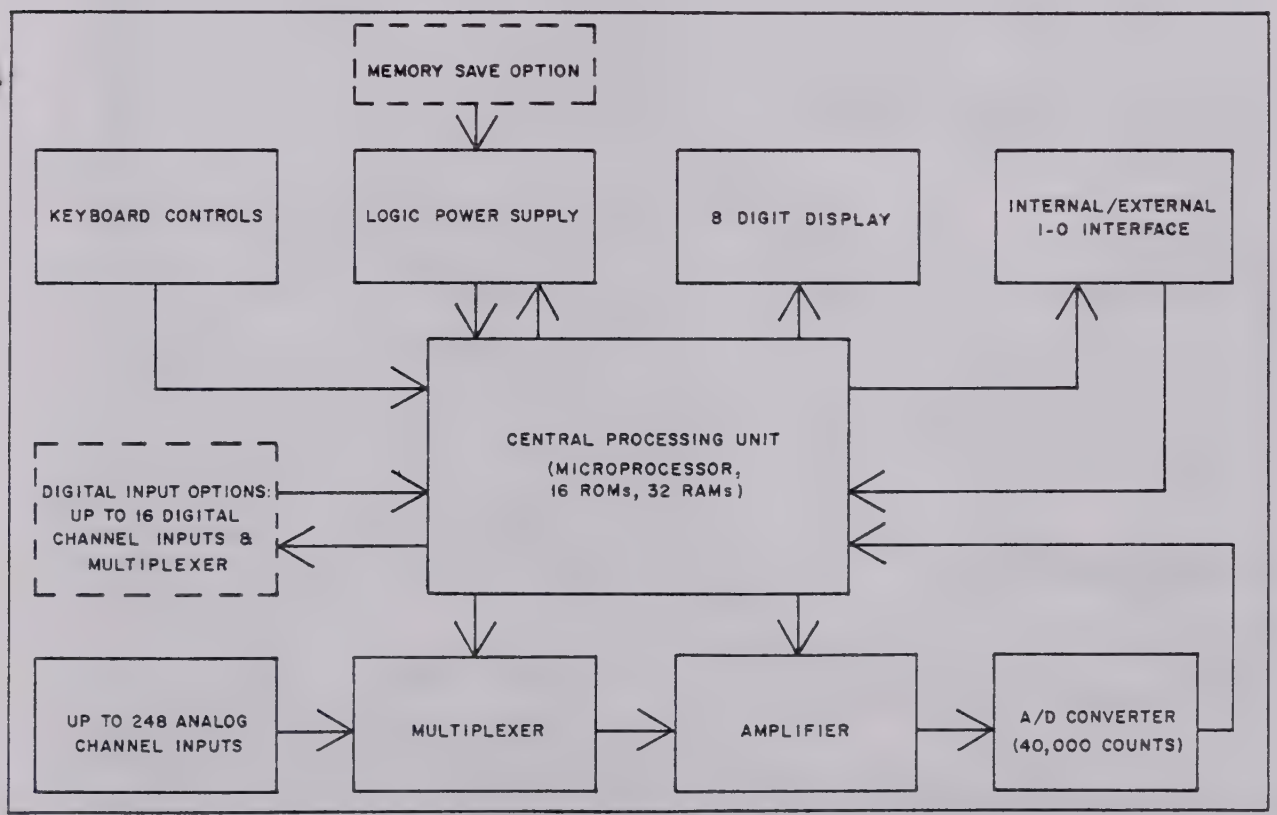


Figure 1-1. Functional Elements of PD-2064 Data System.

d. Some of the main features incorporated in the PD-2064 are listed as follows:

* Up to 64 self-contained analog channel inputs; expandable to 248 analog inputs via external package. Optional digital inputs (up to 16 channels maximum) may be combined with analog inputs. For each digital channel input, total analog channel density is reduced by one.

* Handles up to 4 different thermocouple input types in single system plus millivolts, volts, non-linear functions, process signals, and digital (BCD) inputs.

* Low-level sensing to 1μV resolution, 0 to 40 mV or higher input ranges. Measurement process is immune to noise -- uses dual-slope integration with one cycle of line frequency per analog signal sampling period. Three-wire switching isolation relays, ±200V DC common mode. Guard shield envelops all analog circuitry. Automatic signal source check.

* Crystal-controlled clock, memory-save option (with battery-charger electronics), and internal voltage reference source.

* Output combinations of self-contained (or external) printer, mag tape, paper tape, Teletype, modem, and others. High/low alarms optional each channel.

* Microprocessor accommodates optional special ROM programs such as ratios, rates of change, accumulation, various math functions, and dedicated initialization ROM with keyboard override.

1.2 SYSTEM DESCRIPTION

The PD-2064 may logically be divided into subsections with respect to its functional aspects as illustrated in the block diagram of Figure 1-1. A description of each of these subsections follows.

1.2.1 CENTRAL PROCESSING UNIT(CPU)

a. System control is accomplished through use of a 4-bit microprocessor which serves as the data handling, arithmetic calculating, and decision making unit.

b. Instructions for the microprocessor are stored in as many as 16 read only memories (ROMs) and 32 random access memories (RAMs). The memories contain instructions for performing a variety of functions. Among these functions are instructions for linearizing thermocouple signals, for scaling, for applying coefficients, for reading out measurements directly in engineering units, for alarm setpoints, for temporary memory, and for data formatting.

c. The microprocessor together with the applicable ROMs and RAMs plug into designated slots on the CPU card (Figure 1-3).

d. The basic PD-2064 system consists of a minimum of 6 ROMs with provision for an additional 10 ROM options. Refer to specific ROM allocations and their corresponding functions in Figure 1-3.

e. All variable instrument settings are stored in random access memory (RAM). This memory is of the semiconductor type which is volatile (i.e., data is lost from memory when instrument power is turned off). The basic system accommodates up to 12 RAM storage locations on the CPU card (Figure 1-3), and up to 20 additional RAM storage locations are provided on an optional RAM expansion card (see card location in Figure 1-2). The basic system uses one RAM for storage of system constants. The remaining number of RAMs is shared between the number of signal inputs and the number of alarm setpoints (if "Alarm" option is used). The RAM allocations for channel inputs and optional alarm setpoints are listed in Table 3-1 of Section 3 in this manual.

f. The timing for CPU operations and the time measurement of the system is provided by a six megahertz crystal-controlled oscillator. The timing is arranged for counting down to one second pulse rates for easy implementation of time intervals to any value up to 99 days, 23 hours, 59 minutes, and 59 seconds. Standard accuracy of timing configuration is ±0.0025% with a high-stability option providing an optimum accuracy of ±0.0001%. The clock oscillators are interchangeable.

1.2.2 SIGNAL INPUTS

a. Both analog and digital inputs may be combined into the same data system. Analog inputs are standard; digital inputs are optional.

b. The basic system can accept a total of 248 analog channels provided no digital channels or optional alarm setpoints are included. A total of 16 digital channel inputs may be included in the system.

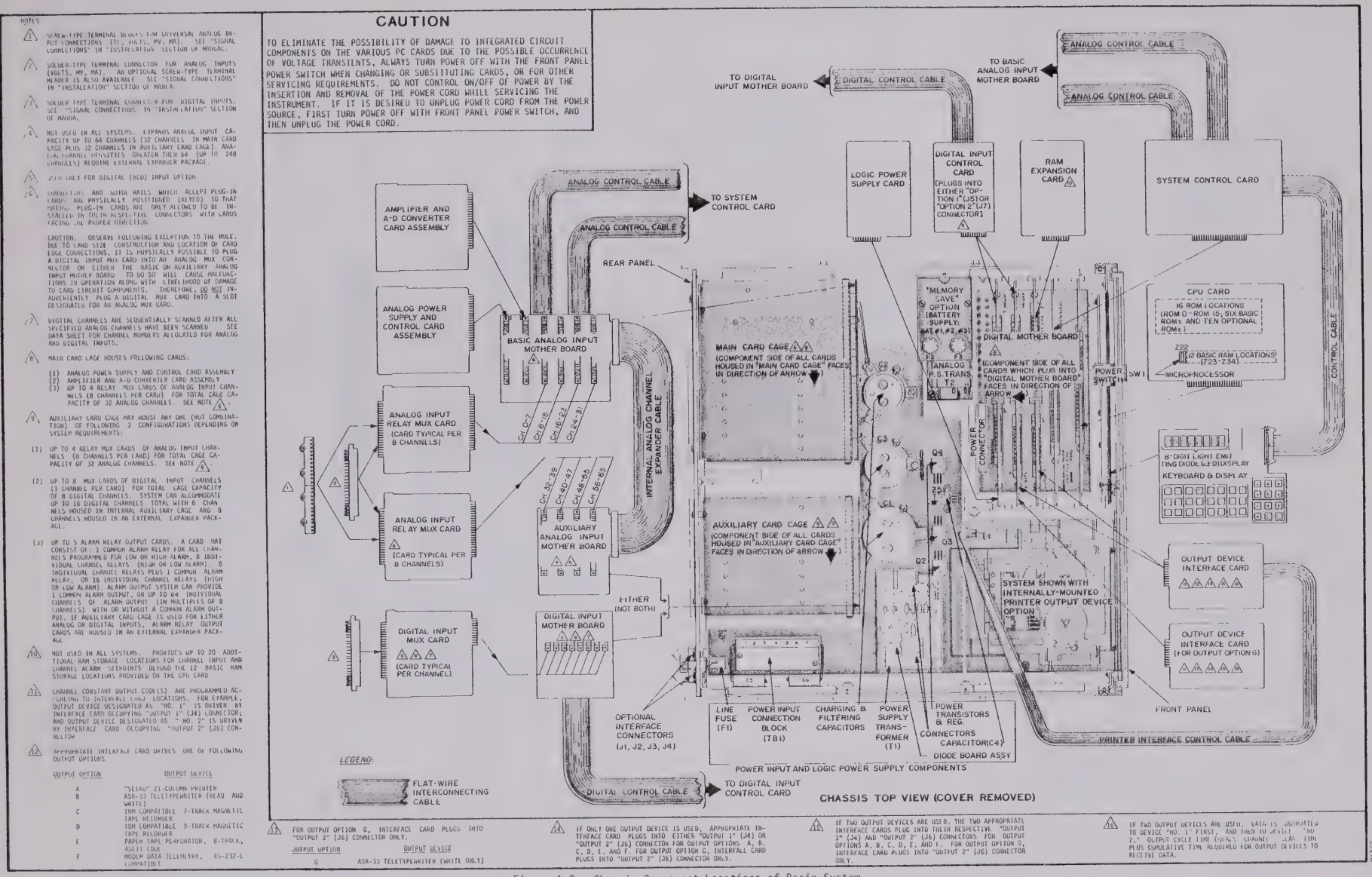

CAUTION
TO ELIMINATE THE POSSIBILITY OF DAMAGE TO INTEGRATED CIRCUIT COMPONENTS ON THE VARIOUS PC CARDS DUE TO THE POSSIBLE OCCURRENCE OF VOLTAGE TRANSIENTS, ALWAYS TURN POWER OFF WITH THE FRONT PANEL POWER SWITCH WHEN CHANGING OR SUBSTITUTING CARDS, OR FOR OTHER SERVICING REQUIREMENTS. DO NOT CONTROL ON/OFF OF POWER BY THE INSERTION AND REMOVAL OF THE POWER CORD WHILE SERVICING THE INSTRUMENT. IF IT IS DESIRED TO UNPLUG POWER CORD FROM THE POWER SOURCE, FIRST TURN POWER OFF WITH FRONT PANEL POWER SWITCH, AND THEN UNPLUG THE POWER CORD.
NOTES
1 SCREW-TYPE TERMINAL BOARDS FOR UNIVERSAL ANALOG INPUT CONNECTIONS (IE, VOLTS, MV, MA). SEE "SIGNAL CONNECTIONS" IN "INSTALLATION" SECTION OF MANUAL.
2 SOLDER-TYPE TERMINAL CONNECTOR FOR ANALOG INPUTS (VOLTS, MV, MA). AN OPTIONAL SCREW-TYPE TERMINAL HEADER IS ALSO AVAILABLE. SEE "SIGNAL CONNECTIONS" IN "INSTALLATION" SECTION OF MANUAL.
3 SOLDER TYPE TERMINAL CONNECTOR FOR DIGITAL INPUTS. SEE "SIGNAL CONNECTIONS" IN "INSTALLATION" SECTION OF MANUAL.
4 NOT USED IN ALL SYSTEMS. EXPANDS ANALOG INPUT CAPACITY UP TO 64 CHANNELS (32 CHANNELS IN MAIN CARD CAGE PLUS 32 CHANNELS IN AUXILIARY CARD CAGE). ANALOG CHANNEL CAPACITIES GREATER THEN 64 (UP TO 248 CHANNELS) REQUIRE EXTERNAL EXPANDER PACKAGE.
5 USED ONLY FOR DIGITAL (BCD) INPUT OPTION
6 CONNECTORS AND GUIDE RAILS WHICH ACCEPT PLUG-IN CARDS ARE PHYSICALLY POSITIONED (KEYED) SO THAT MATING PLUG-IN CARDS ARE ONLY ALLOWED TO BE INSTALLED IN THEIR RESPECTIVE CONNECTORS WITH CARDS FACING IN PROPER DIRECTION
CAUTION. OBSERVE FOLLOWING EXCEPTION TO THE RULE. DUE TO CARD SIZE CONSTRUCTION AND LOCATION OF CARD EDGE CONNECTIONS, IT IS PHYSICALLY POSSIBLE TO PLUG A DIGITAL INPUT MUX CARD INTO AN ANALOG MUX CONNECTOR ON EITHER THE BASIC OR AUXILIARY ANALOG INPUT MOTHER BOARD. TO DO SO WILL CAUSE MALFUNCTIONS IN OPERATION ALONG WITH LIKELIHOOD OF DAMAGE TO CARD CIRCUIT COMPONENTS. THEREFORE, DO NOT INADVERTENTLY PLUG A DIGITAL MUX CARD INTO A SLOT DESIGNATED FOR AN ANALOG MUX CARD.
7 DIGITAL CHANNELS ARE SEQUENTIALLY SCANNED AFTER ALL SPECIFIED ANALOG CHANNELS HAVE BEEN SCANNED. SEE DATA SHEET FOR CHANNEL NUMBERS ALLOCATED FOR ANALOG AND DIGITAL INPUTS.
8 MAIN CARD CAGE HOUSES FOLLOWING CARDS:
(1) ANALOG POWER SUPPLY AND CONTROL CARD ASSEMBLY
(2) AMPLIFIER AND A-D CONVERTER CARD ASSEMBLY
(3) UP TO 4 RELAY MUX CARDS OF ANALOG INPUT CHANNELS (8 CHANNELS PER CARD) FOR TOTAL CAGE CAPACITY OF 32 ANALOG CHANNELS. SEE NOTE 1
9 AUXILIARY CARD CAGE MAY HOUSE ANY ONE (BUT COMBINATION) OF FOLLOWING 3 CONFIGURATIONS DEPENDING ON SYSTEM REQUIREMENTS:
(1) UP TO 4 RELAY MUX CARDS OF ANALOG INPUT CHANNELS (8 CHANNELS PER CARD) FOR TOTAL CAGE CAPACITY OF 32 ANALOG CHANNELS. SEE NOTE 1
(2) UP TO 8 MUX CARDS OF DIGITAL INPUT CHANNELS (1 CHANNEL PER CARD) FOR TOTAL CAGE CAPACITY OF 8 DIGITAL CHANNELS. SYSTEM CAN ACCOMMODATE UP TO 16 DIGITAL CHANNELS TOTAL WITH 8 CHANNELS HOUSED IN INTERNAL AUXILIARY CAGE AND 8 CHANNELS HOUSED IN AN EXTERNAL EXPANDER PACKAGE.
(3) UP TO 5 ALARM RELAY OUTPUT CARDS. A CARD MAY CONSIST OF: 1 COMMON ALARM RELAY FOR ALL CHANNELS PROGRAMMED FOR LOW OR HIGH ALARM, 8 INDIVIDUAL CHANNEL RELAYS (HIGH OR LOW ALARM), 8 INDIVIDUAL CHANNEL RELAYS PLUS 1 COMMON ALARM RELAY, OR 16 INDIVIDUAL CHANNEL RELAYS (HIGH OR LOW ALARM). ALARM OUTPUT SYSTEM CAN PROVIDE 1 COMMON ALARM OUTPUT, OR UP TO 64 INDIVIDUAL CHANNELS OF ALARM OUTPUT (IN MULTIPLES OF 8 CHANNELS) WITH OR WITHOUT A COMMON ALARM OUTPUT. IF AUXILIARY CARD CAGE IS USED FOR EITHER ANALOG OR DIGITAL INPUTS, ALARM RELAY OUTPUT CARDS ARE HOUSED IN AN EXTERNAL EXPANDER PACKAGE
10 NOT USED IN ALL SYSTEMS. PROVIDES UP TO 20 ADDITIONAL RAM STORAGE LOCATIONS FOR CHANNEL INPUT AND CHANNEL ALARM SETPOINTS BEYOND THE 12 BASIC RAM STORAGE LOCATIONS PROVIDED ON THE CPU CARD
11 CHANNEL CONSTANT OUTPUT CODE(S) ARE PROGRAMMED ACCORDING TO INTERFACE CARD LOCATIONS. FOR EXAMPLE, OUTPUT DEVICE DESIGNATED AS "NO. 1" IS DRIVEN BY INTERFACE CARD OCCUPYING "OUTPUT 1" (J4) CONNECTOR; AND OUTPUT DEVICE DESIGNATED AS "NO. 2" IS DRIVEN BY INTERFACE CARD OCCUPYING "OUTPUT 2" (J5) CONNECTOR
12 APPROPRIATE INTERFACE CARD DRIVES ONE OF FOLLOWING OUTPUT OPTIONS
OUTPUT OPTION / OUTPUT DEVICE
A "SELTAU" 21-COLUMN PRINTER
B ASR-33 TELETYPEWRITER (READ AND WRITE)
C IBM COMPATIBLE 7-TRACK MAGNETIC TAPE RECORDER
D IBM COMPATIBLE 9-TRACK MAGNETIC TAPE RECORDER
E PAPER TAPE PERFORATOR, 8-TRACK, ASCII CODE
F MODEM DATA TELEMETRY, RS-232-C COMPATIBLE
13 FOR OUTPUT OPTION G, INTERFACE CARD PLUGS INTO "OUTPUT 2" (J6) CONNECTOR ONLY.
OUTPUT OPTION / OUTPUT DEVICE
G ASR-33 TELETYPEWRITER (WRITE ONLY)
14 IF ONLY ONE OUTPUT DEVICE IS USED, APPROPRIATE INTERFACE CARD PLUGS INTO EITHER "OUTPUT 1" (J4) OR "OUTPUT 2" (J6) CONNECTOR FOR OUTPUT OPTIONS A, B, C, D, E, AND F. FOR OUTPUT OPTION G, INTERFACE CARD PLUGS INTO "OUTPUT 2" (J6) CONNECTOR ONLY.
15 IF TWO OUTPUT DEVICES ARE USED, THE TWO APPROPRIATE INTERFACE CARDS PLUG INTO THEIR RESPECTIVE "OUTPUT 1" (J4) AND "OUTPUT 2" (J6) CONNECTORS FOR OUTPUT OPTIONS A, B, C, D, E, AND F. FOR OUTPUT OPTION G, INTERFACE CARD PLUGS INTO "OUTPUT 2" (J6) CONNECTOR ONLY.
16 IF TWO OUTPUT DEVICES ARE USED, DATA IS SUBMITTED TO DEVICE "NO. 1" FIRST, AND THEN TO DEVICE "NO. 2." OUTPUT CYCLE TIME EQUALS CHANNEL SCAN TIME PLUS CUMULATIVE TIME REQUIRED FOR OUTPUT DEVICES TO RECEIVE DATA.
TO DIGITAL INPUT MOTHER BOARD
DIGITAL CONTROL CABLE
TO BASIC ANALOG INPUT MOTHER BOARD
ANALOG CONTROL CABLE
ANALOG CONTROL CABLE
LOGIC POWER SUPPLY CARD
DIGITAL INPUT CONTROL CARD (PLUGS INTO EITHER "OPTION 1" (J5) OR "OPTION 2" (J7) CONNECTOR) 15
RAM EXPANSION CARD 16
SYSTEM CONTROL CARD
ANALOG CONTROL CABLE
TO SYSTEM CONTROL CARD
ANALOG CONTROL CABLE
AMPLIFIER AND A-D CONVERTER CARD ASSEMBLY
ANALOG POWER SUPPLY AND CONTROL CARD ASSEMBLY
REAR PANEL
BASIC ANALOG INPUT MOTHER BOARD 4
"MEMORY SAVE" OPTION (BATTERY SUPPLY: BAT #1, #2, #3)
CPU CARD
16 ROM LOCATIONS (ROM 0 - ROM 15; SIX BASIC ROMs AND TEN OPTIONAL ROMs)
12 BASIC RAM LOCATIONS (Z23-Z34)
MICROPROCESSOR
MAIN CARD CAGE 4 8
(COMPONENT SIDE OF ALL CARDS HOUSED IN "MAIN CARD CAGE" FACES IN DIRECTION OF ARROW)
DIGITAL MOTHER BOARD 4
(COMPONENT SIDE OF ALL CARDS WHICH PLUG INTO "DIGITAL MOTHER BOARD" FACES IN DIRECTION OF ARROW)
P.S. TRANS.
POWER SWITCH
SW1
CONTROL CABLE
ANALOG INPUT RELAY MUX CARD (CARD TYPICAL PER 8 CHANNELS)
CH 0-7
CH 8-15
CH 16-23
CH 24-31
INTERNAL ANALOG CHANNEL EXPANDER CABLE
POWER CONNECTOR
8-DIGIT LIGHT EMITTING DIODE (LED) DISPLAY
KEYBOARD & DISPLAY
ANALOG INPUT RELAY MUX CARD 4 (CARD TYPICAL PER 8 CHANNELS)
CH 32-39
CH 40-47
CH 48-55
CH 56-63
AUXILIARY ANALOG INPUT MOTHER BOARD 4 8
AUXILIARY CARD CAGE 4 8 9
(COMPONENT SIDE OF ALL CARDS HOUSED IN "AUXILIARY CARD CAGE" FACES IN DIRECTION OF ARROW)
SYSTEM SHOWN WITH INTERNALLY-MOUNTED PRINTER OUTPUT DEVICE OPTION
OUTPUT DEVICE INTERFACE CARD 4 12
OUTPUT DEVICE INTERFACE CARD (FOR OUTPUT OPTION G)
EITHER (NOT BOTH)
DIGITAL INPUT MOTHER BOARD
DIGITAL INPUT MUX CARD 4 (CARD TYPICAL PER CHANNEL)
FRONT PANEL
OPTIONAL INTERFACE CONNECTORS (J1, J2, J3, J4)
LINE FUSE (F1)
POWER INPUT CONNECTION BLOCK (TB1)
CHARGING & FILTERING CAPACITORS
POWER SUPPLY TRANSFORMER (T1)
POWER TRANSISTORS & REG. CONNECTORS
CAPACITOR(C4)
DIODE BOARD ASSY
PRINTER INTERFACE CONTROL CABLE
POWER INPUT AND LOGIC POWER SUPPLY COMPONENTS
LEGEND:
FLAT-WIRE INTERCONNECTING CABLE
DIGITAL CONTROL CABLE
TO DIGITAL INPUT CONTROL CARD
CHASSIS TOP VIEW (COVER REMOVED)

Figure 1-2. Chassis Component Locations of Basic System.

NOTE: For each digital channel input used, total analog channel capacity is reduced by one.

c. As many as 8 different measuring ranges may be accommodated by the system at one time; and virtually any type of transducer at any signal level is acceptable, including non-linear thermocouples.

d. Descriptions of the thermocouple input option and digital input option are given in "Section C" of the Appendix. Instructions for making analog (including thermocouple) and digital signal input connections are covered in the "Installation" section of manual.

1.2.3 ANALOG MULTIPLEXING

a. All analog circuitry is enclosed in metal card cages which electrically isolate and shield the low-level signal inputs from stray AC fields and common mode voltages. Each card cage serves as a floating guard-shield to provide AC and DC isolation up to 125V AC (RMS) and ±200V DC, respectively. The card cage is electrically connected to the input guard terminal (G) of each individual channel as it is being scanned.

b. The relays used in the multiplexer are encapsulated, 3-pole, reed type and provide 3-wire signal input switching (high, low, and guard). Relays are rated at 200V DC or peak

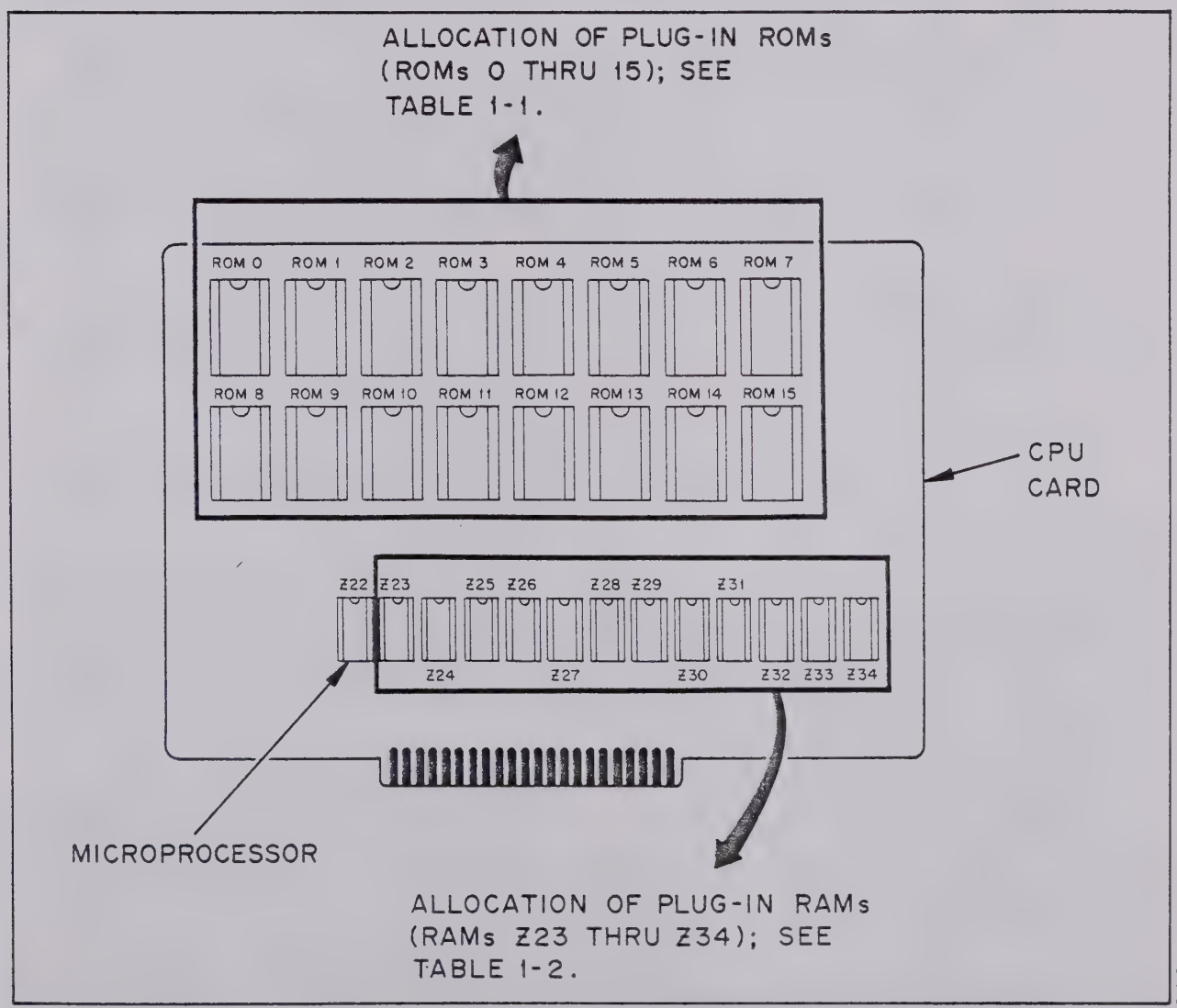


Figure 1-3. ROM & RAM Allocations on CPU Card.

AC switching voltage and 300V DC or peak AC breakdown voltage with less than a 1μV thermal offset effect over operating temperature range of 0 - 50°C.

c. To ensure signal integrity, optical couplers are used to isolate the digital power supply and its associated logic circuits from the analog power supply and its associated logic circuits.

d. Each analog relay mux card contains 8 relay multiplexers for the input processing of 8 analog channels. Up to 4 relay mux cards may be housed in each of the two card cages to provide an input capability of 64 self-contained channels. Expansion of analog channels beyond 64 (up to 248) requires auxiliary card cages which are housed in an expander package the same size as the basic PD-2064 unit.

Table 1-1. ROM Allocations.

ROM POSITION *		PROGRAM FUNCTION
Basic	Optional	
ROM 0	—	System Initialization (Clock Timing).
ROM 1	—	Subroutines (Per Channel Pair or Per Single Channel—See Data Sheet).
ROM 2	—	Start Initialization (Keyboard Entry 1).
ROM 3	—	System Variables (Keyboard Entry 2).
—	ROM 4	Custom Initialization of System (Free Choice or Pre-Selected—See Data Sheet).
ROM 5	—	Output Device No. 1
—	ROM 6	Output Device No. 2
ROM 7	—	A/D Control (Read).
—	ROM 8	Alarms (or Some Other Common Correction Function—See Data Sheet).
—	ROM 9	System Constant (Program) Printout.
—	ROM 10, 11, 12, or 13	Thermocouple Linearization, Math Function, (or Some Other Specific Correction Function—See Data Sheet).
—	ROM 14	Common Correction for Thermocouple Linearization; Required When Any TC Linearization ROM (10, 11, 12, or 13) is Used.
—	ROM 15	Digital Input Control

* ROM is identified by E. A. part number stamped or written on underside of body.

PART NUMBER BREAKDOWN: If ROM is programmed by ROM manufacturer, only last 6 digits of part number appear on part.

Example: P ROM 1302 01 001

- 001 — ROM Program Number
- 01 — Position on CPU Card
- 1302 — Manufacturer's Part Number ROM (Intel 1302A) or PROM (Intel 1702A)
- ROM — Read Only Memory Device
- P — Programmable

Table 1-2. RAM Allocations.

RAM ** POSITION	VARIABLE INFORMATION STORAGE
Z23	System Constants
Z24 thru Z34	RAM storage allocations are shared between number of channel inputs and number of optional alarm setpoints. Allocations vary depending on system requirements (see Data Sheet) and may be exchanged at the rate listed in Table 3-1 of Section 3 in manual. NOTE: 20 additional RAM storage locations for channel data and/or alarm setpoints are provided on optional RAM expansion card (see card location in Figure 1-2). Refer to supplemental instructions in Section G of manual for breakdown of RAM allocations assignable to channel data and alarm setpoints.[1]

** RAMS are identified with the RAM manufacturer's part number, either Intel #4002-1 or 4002-2, directly stamped on the part. The E.A. part number equivalents are #MOS4002-1 and MOS4002-2, respectively. The RAM positions on the CPU card are arranged in pairs with alternating part numbers assigned to each pair. The first RAM pair (Z23, Z24) is identified with part number 4002-1 (E.A. #MOS4002-1), the second pair (Z25, Z26) with part number 4002-2 (E.A. #MOS4002-2), the third pair (Z27, Z28) with part number 4002-1 (E.A. #MOS4002-1), and so forth. This same sequencing of pairs versus part number assignments also applies to the RAM positions on the RAM expansion card with the odd-numbered RAM pairs (i.e., Z1, Z3 etc.) having part number 4002-1 (E.A. #MOS4002-1) assignment, and even-numbered RAM pairs (i.e., Z2, Z4 etc.) having part number 4002-2 (E.A. #MOS4002-2) assignment.

NOTE: When plugging RAMs into their respective sockets, make sure to conform with the pair/part numbering pattern to ensure proper operation.

1.2.4 ANALOG MEASUREMENT

a. The measurement process of the analog input signals are controlled by the microprocessor in a period of a few milliseconds.

b. TRIPLE AUTO ZERO CIRCUIT: The measurement cycle of each channel's input starts with an "all channel disable" signal. During this time, all relay multiplexers are de-energized to disconnect all channel inputs from the amplifier. At the same time, a "clamp" signal shorts (via FET switches and relay) the following three circuits to signal low (see Figure 1-4): (1) the channel input to the amplifier, (2) the output of the amplifier, and (3) the zero circuit within the A-D converter module. The shorting of these three circuits ensures an absolute minimum of offset microvoltage which often results from the input and output characteristics of the amplifier.

c. AUTOMATIC OPEN CIRCUIT CHECK: A few milliseconds after the triple zeroing function, another circuit automatically tests the continuity of each signal source prior to taking

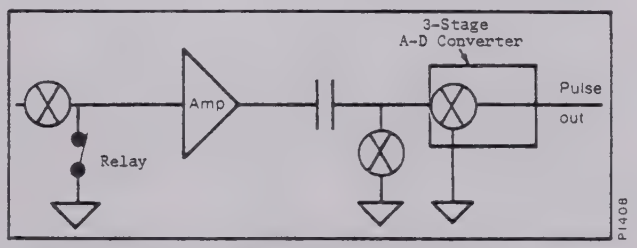


Figure 1-4. Triple Zero Set Circuit.

[1]For RAM allocations applicable to the "Class A" alarm setpoint configuration, refer to instruction Form #PD-2064MSL found in "Section G" of the Appendix. For RAM allocations pertaining to the "Class B" alarm setpoint configuration, refer to instruction Form #PD-2064AAS found in "Section G" of the Appendix.

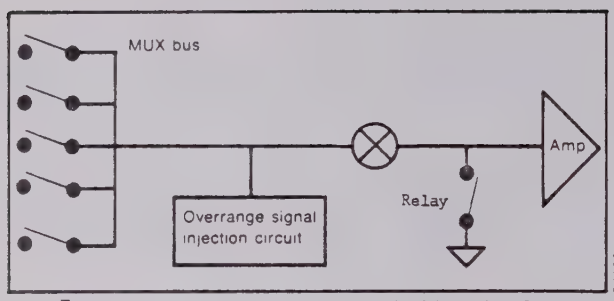


Figure 1-5. Automatic Check Circuit for Open Inputs.

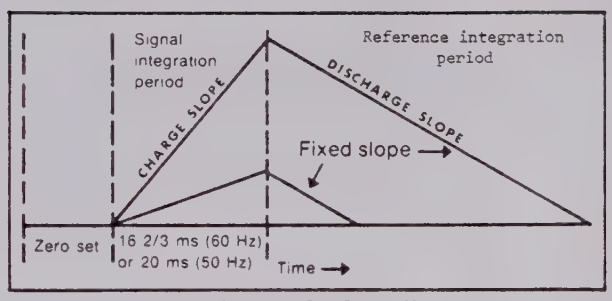


Figure 1-6. A-D Dual-Slope Measurement Conversion.

its measurement (see Figure 1-5). A voltage pulse is injected into the signal source. If the signal cable is disconnected or if signal source actually becomes open (i.e., thermocouple burnout), measurement will indicate an overrange condition which serves as an alert to the operator for remedial action before system operation is continued. For check circuit to function properly, signal cable capacitance should not exceed 0.01µF.

1.2.5 AMPLIFIER AND A-D CONVERTER

a. The amplifier receives the multiplexed analog input signals, preconditions the signals through range-determining networks (amplification or attenuation), and then applies them to the bipolar, ±4V, full-scale measuring circuitry of the A-D converter. Signal amplification is performed by a precision, temperature-compensated, chopper-stabilized op-amp.

b. Signal measurement is made by a three-stage, dual-slope, A-D (analog-to-digital) converter. The A-D converter is a modular plug-in circuit that plugs onto the component side of the amplifier card assembly.

c. The A-D control logic signals applied to the module initiate three stages of operation involved in the A-D measurement process. These three stages are: (1) automatic zeroing as described under paragraph 1.2.4b, (2) signal integration period, and (3) reference integration period. Refer to Figure 1-6.

d. The internal Integrator of the converter module is charged by the analog input voltage for an integration period equivalent to one cycle of line frequency (Figure 1-7). The input integration being timed in this manner provides excellent immunity from normal mode noise voltages.

e. After signal integration period, the input to the integrator is switched to a stable, precision, internal reference voltage causing the integrator to discharge to zero. Since the charge slope is proportional to the input voltage and the discharge slope is fixed, the reference integration time taken for discharge of the Integrator is proportional to the input voltage. Therefore, a voltage-to-time conversion is achieved.

f. During the reference integration period, clock pulses generated by a crystal-controlled oscillator are counted by a counter to provide a digital measurement (40,000 counts = full scale) of the analog input voltage.

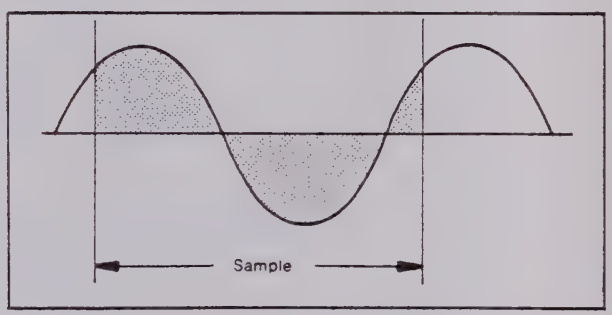


Figure 1-7. Signal Integration Period Equals One Cycle of Power Line Frequency.

1.2.6 FRONT PANEL DISPLAY

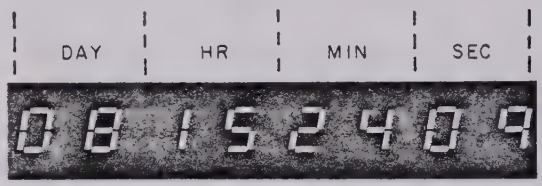
a. The display is comprised of eight, seven-segmented light emitting diode (LED) readout devices. These displays provide .3 inch (7.6 mm) high characters which enable clear and easy reading from a distance.

b. In addition to monitoring the prevailing real time and channel signal levels, display serves as a setup and programming aid that enables the operator to recall from CPU memory any stored data, time, or programmed operating codes. When channel parameters are changed, new entries can be quickly observed on the display for a step-by-step checkout of the programming.

c. Clock timing of the system is kept on a 24-hour astronomic basis. For example, Monday at 7:30:30 P.M. could be displayed in astronomic time as 02 19 30 30 where day (02) is Monday.

d. Analog data is presented in direct 4.4 digit format with floating decimal point and minus (-) polarity sign. Positive polarity of data is implied and has no sign indication. Overrange data values are indicated by a letter "L" preceding the data.

e. As a special option on slow-scan systems, a program can be furnished to give an alternating display of channel number and channel data for each channel addressed (consult factory).



Time reads 8 days, 15 hours, 24 minutes, and 9 seconds.



Data reads minus 0498.3 mV on 4000 mV range.



Data reads positive 125.68 mV on 400 mV range. Positive sign (+) is implied and not indicated.



Data reads overrange value of positive 41.249 mV on 40 mV range.



Display reads all L's when instrument is ready to accept keyboard instructions (initial load point).

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Figure 1-8. Typical Readouts on Display.

f. Another option is available whereby display is mounted in a separate enclosure with the keyboard to permit remote control operation of the data system. For further information on this option, refer to paragraph D.2 in "Section D" of the Appendix.

1.2.7 KEYBOARD

a. The power on-off switch and the instrument keyboard are used to control system operation and to program the various data entry functions. The keyboard provides maximum versatility in establishing operational sequences, channel-by-channel functional programming, setting precise timing intervals, setting of alarm setpoints, calling in math functions, and setup of many other functions.

b. The keyboard is arranged into four separate groups of color-coded keys, with each group assigned to particular programming functions. Each key is identified with its primary functional name. Refer to "Operation" section of manual for detailed functional description of each key (see Figure 3-1) and for keyboard programming procedures (see operational flow diagram foldouts at end of Section 3).

c. As a special option, keyboard and display are mounted in a separate unit to enable remote operation of the data system. This option is described under paragraph D.2 in "Section D" of the Appendix.

1.2.8 INTERNAL/EXTERNAL I-O INTERFACE

a. Various output device interface options may be used with the PD-2064 data system. Besides the internally-mounted Seiko printer output device, other options such as Teletype, paper or mag tape recorders, and data telemetry (modem) equipment are also available.

b. Any two of the same or different type output devices can be interfaced to the PD-2064 at the same time. For coverage of output device options, refer to "Section B" in the Appendix of this manual.

1.2.9 LOGIC POWER SUPPLY

a. As shown in the block diagram of Figure 1-9, the logic power supply furnishes five DC operating voltages for the digital circuitry of the data system.

b. The tapped, dual-primary winding of the logic power supply transformer provides system

flexibility by permitting AC operation from any one of the following 50/60 Hz input power sources: 100V, 120V, 200V, 220V or 240V. Refer to Figure 2-1 in Section 2 of manual for alternate connections of transformer primary windings on terminal block TB1.

c. The three secondary windings (centertapped) of the power transformer are connected to three separate rectifier circuits on the diode board assembly. Diodes rectify the applied AC secondary voltages to pulsating DC, and then the DC is filtered by capacitors C1, C2, and C3. From this point, the DC voltages are fed to the various regulator circuits for further control before being applied to the system logic.

d. The +16V DC and +12V DC sources are provided to power the various optional output devices which may be interfaced to the data system. A +5V source (+5Vs) in addition to the +16V and +12V sources are switched on and off under the control of the microprocessor depending on the mode of operation selected.

e. For example, in the "Auto" mode of operation, the +16V, +12V, and +5Vs supplies are turned "on" during channel scanning, measuring, and data outputting operations; and then the three supplies are turned "off" for the time period between channel frame scans so that output devices are powered down. If the "Input" mode is selected, these three DC sources are kept turned "on" so that system can perform its programmed operations of scanning, measuring, and outputting of channel data with output devices remaining powered up at all times.

f. In addition to the +16V, +12V, and +5Vs switched supplies, uninterrupted +5V DC and -10V DC sources are also provided for operation of the system logic.

1.2.10 'MEMORY SAVE' CIRCUITRY

a. The logic power supply may also be equipped with the optional "Memory Save" circuit. This option consists of an internal DC battery source which is automatically switched into operation in the event of a power loss at the AC mains while instrument power switch remains in the "on" position.

b. If AC power fails, all DC power sources derived from AC operation of the instrument are shut down. Within 20 milliseconds of AC power failure, a power fail detection and transistor switching circuit connects a 6V battery into the DC power supply to provide a temporary substitute for the +5V (not +5Vs) source. At the same time, series-connected 6V and 4V batteries are switched into the DC power supply to provide a temporary substitute for the -10V source. These battery sources are only designed to sustain operations of the microprocessor and to save programs stored in the RAMs for a relatively short period of time (approximately 10 minutes) until AC power can be restored.

c. No substitute DC voltages from the "Memory Save" circuit are provided for the +16V, +12V, and +5Vs sources. Therefore, if AC power should happen to fail, system reverts to the "Auto" mode whereby output devices remain powered down, display is turned off, keyboard is functionally disabled, and channel scanning and data outputting operations are suspended; however, timing circuits continue to operate and CPU unit continues to function so that programs stored in RAMs are retained for a period of approximately 10 minutes.

d. The internal +6V and -10V battery supplies are kept fully charged from +6.8V and -11.25V battery-charger circuits, respectively, when system is normally operated from the AC line.[1]

e. For further description of "Memory Save" option, refer to paragraph 3.5.4 in "Operation" section of manual.

PRECAUTIONARY OPERATING NOTES:

(1) When instrument is equipped with the "Memory Save" option, power should not be interrupted from unit by removing power cord from AC outlet while instrument's power switch is still turned on. To do so will energize the "memory save" circuits and cause needless discharging of the batteries. Therefore, if it is desired to turn the instrument off or unplug the power cord, first shut off power with instrument's power switch.

(2) Restoration of AC power to the PD-2064 may not necessarily bring external output peripherals back on to line power. The AC power to the PD-2064 is independent from the AC power input to any output peripherals connected into the data system. Therefore, if an AC power loss is experienced, make sure that AC power to peripherals, as well as the PD-2064, is back on line power for continued operation of the data system.

(3) The first data scan after a power outage may be erroneous due to the analog power supply start-up conditions. Subsequent scans, however, will be valid.

NOTE: Combination of the "Memory Save" option with other options (such as Integrator or alarm relay outputs) require special consideration. Consult factory.

[1] In the event the PD-2064 is routinely shut down for a period of 3 months or more, the instrument should be turned on at least once every 3 months for a period of 12 hours so that the internal batteries are kept recharged and in a chargeable condition.

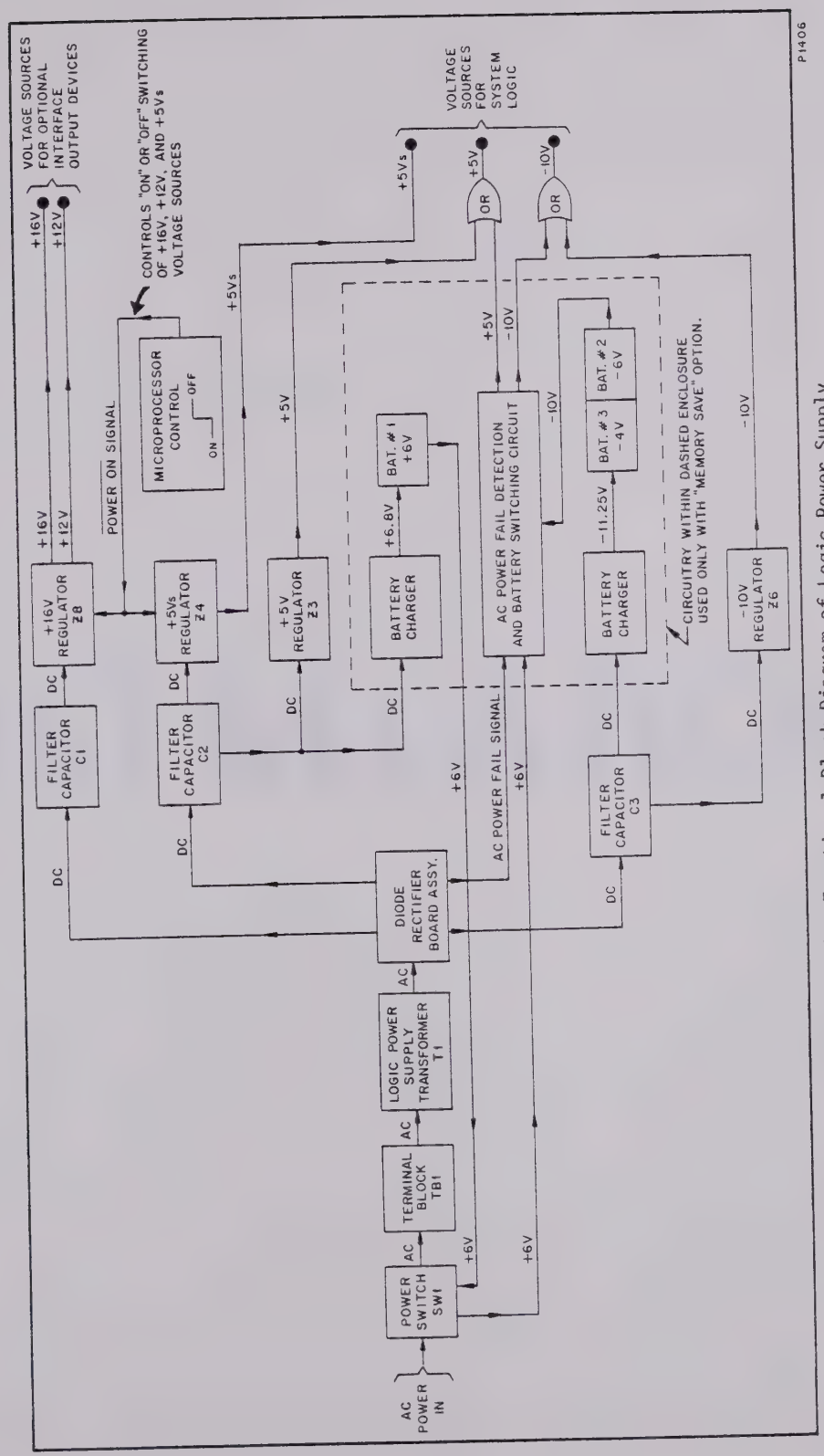


Figure 1-9. Functional Block Diagram of Logic Power Supply.

INSTALLATION

SECTION 2 - INSTALLATION

2.1 INITIAL INSPECTION

a. The Model PD-2064 was carefully checked and calibrated at the factory prior to shipment and should be ready for operation as soon as it is unpacked and set up.

b. Remove the packing material carefully and check off all items listed on the packing slip as they are unpacked. If special and/or accessory items were ordered, they will appear on the packing slip. After all items have been removed, make a complete inspection for physical damage that might have occurred during transit. If the shipment is found to be damaged, notify the carrier and Esterline Angus immediately. If there are electrical and mechanical deficiencies not attributable to shipping, then refer to the statement of Warranty in this manual.

CAUTION: Do not attempt to operate a damaged instrument.

c. Setting up the instrument for operation basically consists of the following procedures:

(1) Checking primary winding connections of instrument's power transformers so that circuit operation will conform with the external source of power being applied (see paragraph 2.2). Input power ratings are specified on the instrument Data Sheet.

(2) Mounting the instrument.

(3) Making the signal connections.

(4) Making necessary interconnections between the PD-2064 unit and optional peripheral devices as specified by the system requirements on the Data Sheet. Refer to applicable instruction supplements covering options incorporated in system. Instruction supplements and drawings as listed on the Data Sheet will be found in the "Appendix" section.

(5) Loading paper and changing ribbon on internally-mounted Seiko printer when it is used as one of the optional output devices. Refer to "Optional Output Devices" section in the "Appendix" of this manual.

(6) Operating the keyboard to program the various functions of the data acquisition system. Refer to "Operation" section in this manual.

2.2 POWER REQUIREMENTS

a. The tapped, dual-primary winding of the logic power supply transformer and the dual-primary winding (untapped) of the analog power supply transformer enable system operation from any one of the following 50/60 Hz input power sources: 100V, 120V, 200V, 220V, or 240V.

b. The proper primary winding connections are factory-wired to a terminal block located on the top of the recorder chassis. These connections conform to the power input requirements specified by the purchaser at time of order (see instrument Data Sheet).

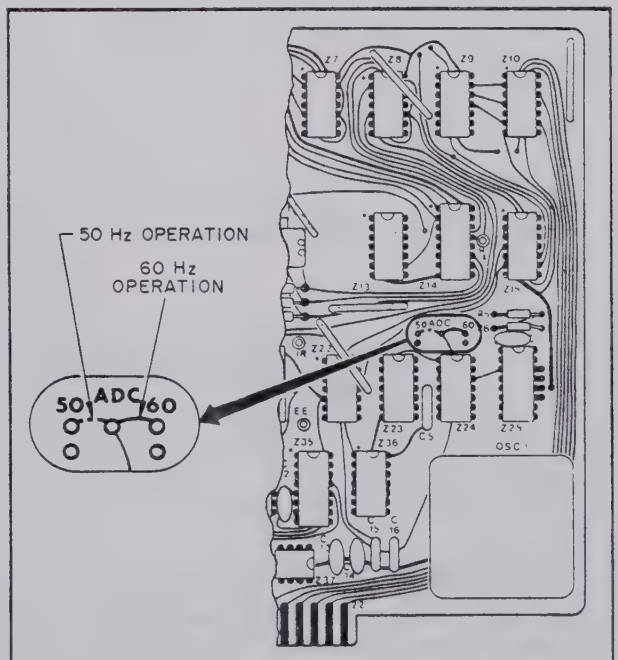
c. If system power requirements change in the field to necessitate a change in the configuration of the power wiring input to transformers T1 and T2, proceed as follows:

(1) Remove 3 top-cover mounting screws at top side of rear panel.

(2) Slide top cover rearward, and then lift cover straight off instrument.

Thereafter, refer to Figure 2-1 and make appropriate power wiring changes on terminal block TB1. Reinstall top cover with 3 mounting screws.

d. If system power frequency is changed in the field (from 60 Hz to 50 Hz, or vice versa), it will also be necessary to make a jumper wiring change on the "System Control Card" as shown below.



SYSTEM CONTROL CARD
(JUMPER LOCATION FOR 50 OR 60 Hz OPERATION)

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2.3 GROUNDING REQUIREMENTS

Power input to the instrument is provided through a 3-conductor power cord that terminates in a 3-prong plug. For the safety of operating personnel, a provision for grounding the instrument case has been provided as recommended by the National Electrical Manufacturer's Association (NEMA). The rounded prong in the power cord plug grounds the instrument case when the plug is inserted into a mating 3-contact outlet that is grounded. If only a 2-contact outlet is available, use a 3-prong to 2-prong adapter and connect the green wire of the adapter to earth ground.

2.4 INSTRUMENT MOUNTING

Model PD-2064 instruments are available with three basic installation-mounting options. These options include:

(1) Bench top mounting with four feet and a retractable tilt bar, with or without carrying handles.

(2) Rack or panel mount without chassis slides.

(3) Rack mount with chassis slides.

> CAUTION: If instrument is optionally equipped with the internally-mounted Seiko printer, do not mount unit in an environment containing iron filings or particles. Such particles are easily attracted to the permanent magnets employed in the printer mechanism. Additionally, instrument should only be installed in a non-condensing atmosphere.

2.4.1 BENCH-STYLE INSTRUMENTS

The Model PD-2064 bench-style instrument is designed to operate in a basically horizontal plane and requires no special installation procedures. Four feet are attached to the bottom of the unit for bench-top applications. A snap-down support raises the front of the instrument so that the front panel is in the optimum viewing position. Refer to the physical dimensions illustration in Figure 2-2 for the bench space required by the instrument.

2.4.2 RACK/PANEL INSTRUMENTS

a. Model PD-2064 instruments designed for either rack or panel installation should be mounted upright in a clean, well-lighted location that is free of excessive dust, steam, moisture, smoke, or corrosive fumes. The unit should not be subjected to extremes of temperature or humidity. The cooling of internal components is accomplished solely by convection; therefore, installation of the instrument must provide for adequate air circulation. In addition, it should not be mounted close to large transformers or near conductors carrying high currents.

b. The depth of the case is 17 1/8" (19 3/16" if optionally equipped with 64-channel universal input panel; or 21 13/16" if optionally equipped with 32-channel universal analog input panel) from the back surface of its mounting flanges. If optional chassis slides are employed, section "A" of the slide is fastened to the instrument side rail and extends 20 13/16" from the back surface of the mounting flanges. Space behind mounting flanges (including the mounting surface thickness) must be sufficient to accommodate the appropriate depth dimensions above; also, additional space for wiring may be required. Allow 22" (minimum) clearance in front of the panel for unit insertion and removal. The overall dimensions of the PD-2064 are given in Figure 2-2.

2.4.3 RACK-MOUNTING PROCEDURES

a. MOUNTING WITHOUT CHASSIS SLIDES: The PD-2064 can be mounted in a standard 19" rack using the two mounting flanges only; however, it is recommended that additional support be fabricated at the rear of the case, particularly if the instrument will be subjected to vibration or shock. Proceed as follows:

(1) Install instrument through front of rack, and position unit in rack with mounting flanges flush against outer side of rack-mounting strips.

(2) Align slots in mounting flanges with desired holes in rack-mounting strips and secure unit using appropriate size screws and suitable nut fasteners (if needed).

b. MOUNTING WITH CHASSIS SLIDES: The optional chassis slides available for the PD-2064 are designed for a standard 19" rack having a depth of at least 22". The maximum extension of these slides permits the PD-2064 to travel a total of 23" for servicing.

> NOTE: Refer to Figure 2-2 for details of chassis-slide installation. Slide section "A" is factory-installed on the PD-2064 side rails; while section "C" is to be installed within the mounting rack. Section "B" merely slides within section "C" and is retained by a mechanical stop.

(1) Determine the desired mounting height for the chassis slides in rack. Position right-hand slide section "C" in rack as shown in Figure 2-2. Secure slide to rack-mounting strip

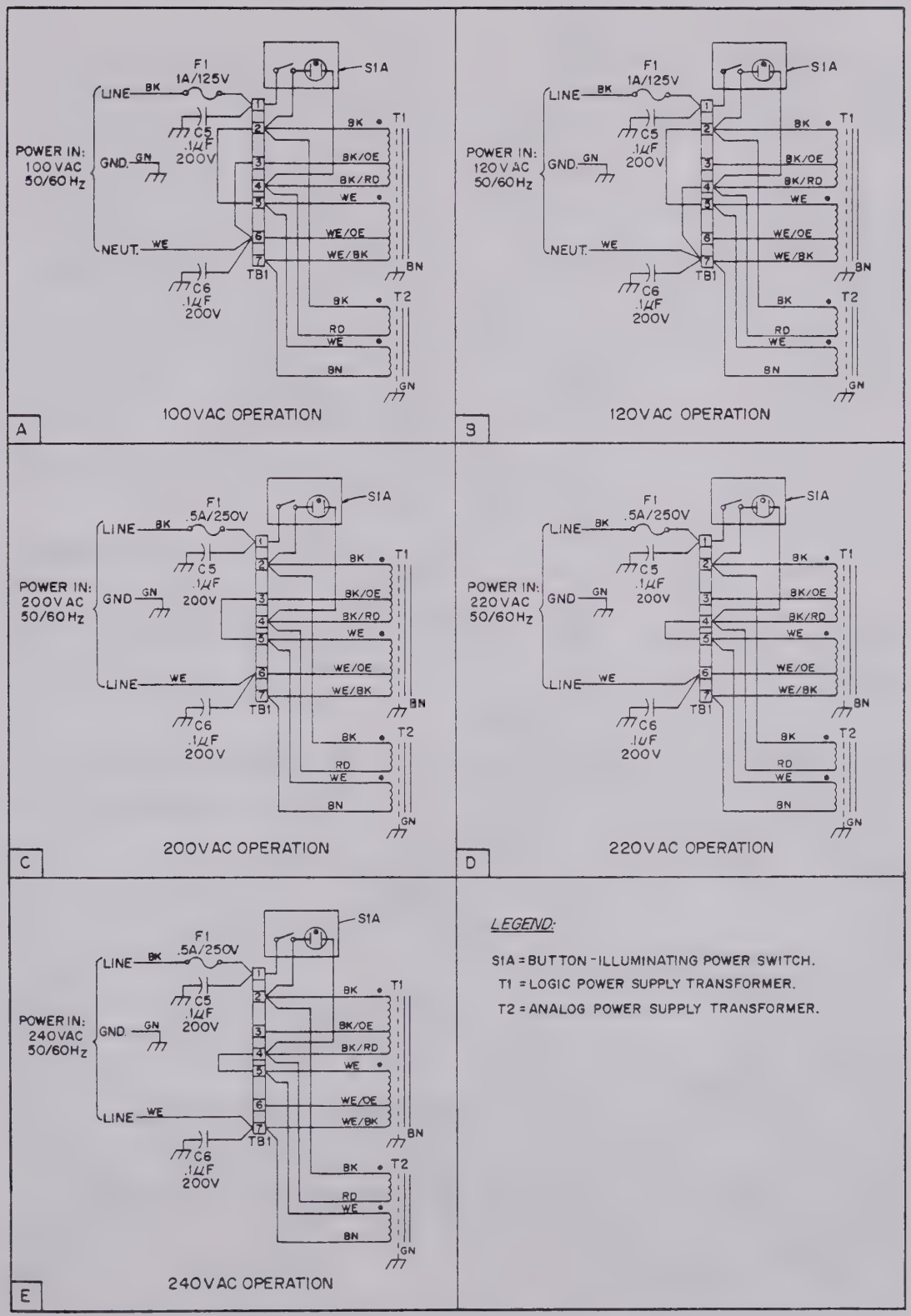


Figure 2-1. Alternate Primary Winding Connections of Power Transformers.

with two #10-32 flat-head screws and a #10-32 bar nut. Adjust slotted rear mounting angle bracket of slide as required and secure bracket to rack support using two #10-32 screws and a #10-32 bar nut.

(2) Install the left-hand slide section "C" in rack in same manner described in Step 1 for the right-hand slide section.

NOTE: Be sure to use the correct section "C" slide for the left and right sides of rack. Slide section "A" on the instrument has a spring-actuated stop pin which mates with a hole in section "B". This self-locking feature between slides "A" and "B" prevents separation of slide "A" from slide B upon extension of the instrument from the rack to safeguard against instrument being dropped. The stop pin and hole are offset vertically from the center of slide and will not engage if a left-hand section "A" is inserted into a right-hand section "B/C".

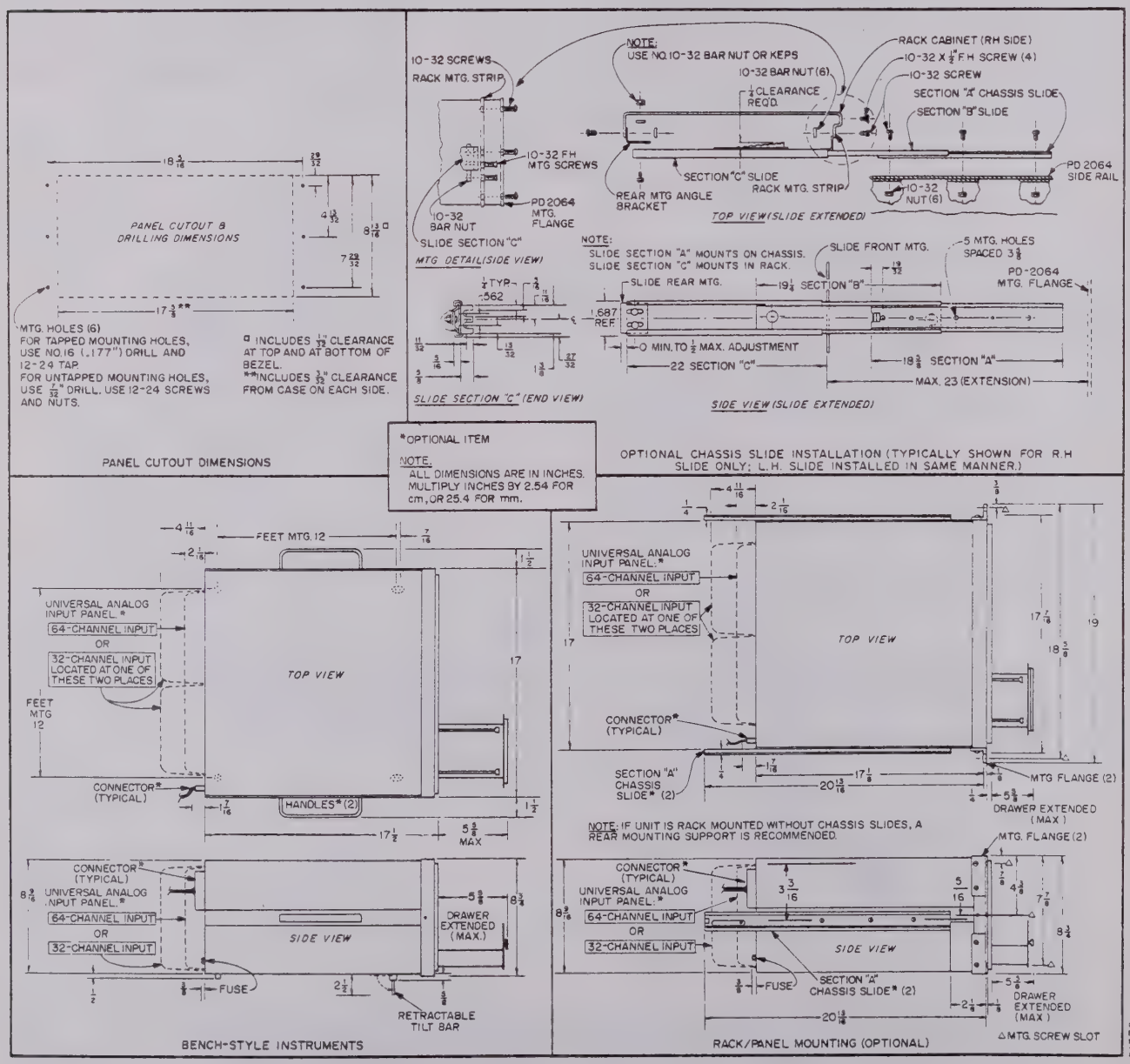

PANEL CUTOUT & DRILLING DIMENSIONS
MTG. HOLES (6)
FOR TAPPED MOUNTING HOLES, USE NO.16 (.177") DRILL AND 12-24 TAP.
FOR UNTAPPED MOUNTING HOLES, USE 7/32" DRILL, USE 12-24 SCREWS AND NUTS.
□ INCLUDES 1/32" CLEARANCE AT TOP AND AT BOTTOM OF BEZEL.
**INCLUDES 3/32" CLEARANCE FROM CASE ON EACH SIDE.
PANEL CUTOUT DIMENSIONS
10-32 SCREWS
RACK MTG. STRIP
NOTE: USE NO.10-32 BAR NUT OR KEPS
10-32 BAR NUT (6)
1/4 CLEARANCE REQ'D.
RACK CABINET (RH SIDE)
10-32 X 3/8" F.H. SCREW (4)
10-32 SCREW
SECTION "A" CHASSIS SLIDE
SECTION "B" SLIDE
10-32 F.H. MTG SCREWS
PD 2064 SIDE RAIL
SECTION "C" SLIDE
RACK MTG. STRIP
REAR MTG ANGLE BRACKET
10-32 NUT (6)
PD 2064 MTG. FLANGE
10-32 BAR NUT
SLIDE SECTION "C"
TOP VIEW (SLIDE EXTENDED)
MTG DETAIL (SIDE VIEW)
NOTE: SLIDE SECTION "A" MOUNTS ON CHASSIS. SLIDE SECTION "C" MOUNTS IN RACK.
SLIDE FRONT MTG.
5 MTG. HOLES SPACED 3 3/8
SLIDE REAR MTG.
SECTION "B"
PD-2064 MTG. FLANGE
.687 REF
0 MIN. TO 3/8 MAX. ADJUSTMENT
22 SECTION "C"
18 3/8 SECTION "A"
MAX. 23 (EXTENSION)
SLIDE SECTION "C" (END VIEW)
SIDE VIEW (SLIDE EXTENDED)
*OPTIONAL ITEM
NOTE: ALL DIMENSIONS ARE IN INCHES. MULTIPLY INCHES BY 2.54 FOR cm, OR 25.4 FOR mm.
OPTIONAL CHASSIS SLIDE INSTALLATION (TYPICALLY SHOWN FOR R.H SLIDE ONLY; L.H. SLIDE INSTALLED IN SAME MANNER.)
FEET MTG. 12
UNIVERSAL ANALOG INPUT PANEL:*
64-CHANNEL INPUT
OR
32-CHANNEL INPUT LOCATED AT ONE OF THESE TWO PLACES
TOP VIEW
FEET MTG 12
CONNECTOR* (TYPICAL)
HANDLES* (2)
SECTION "A" CHASSIS SLIDE* (2)
MTG FLANGE (2)
DRAWER EXTENDED (MAX)
NOTE: IF UNIT IS RACK MOUNTED WITHOUT CHASSIS SLIDES, A REAR MOUNTING SUPPORT IS RECOMMENDED.
SIDE VIEW
FUSE
RETRACTABLE TILT BAR
BENCH-STYLE INSTRUMENTS
RACK/PANEL MOUNTING (OPTIONAL)
△MTG. SCREW SLOT
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Figure 2-2. Physical Dimensions and Mounting Configurations.

(3) Pull both section "B" slides forward to the full extent of their travel; position PD-2064 between these slides and carefully insert the instrument's section "A" slides into the section "B" slides. Push instrument toward rear of rack until stop pins on slide section "A" strike forward end of section "B" slides.

(4) Depress both stop pins while pushing instrument toward rack. After the instrument has moved rearward about five inches, the section "A" stop pins should snap into the section "B" holes. The slide is now capable of supporting the entire weight of the instrument.

(5) Again depress both stop pins while pushing instrument rearward. When the instrument stops, reach inside the rack and carefully pull "out" on the section "C" stop-pin springs. Push the PD-2064 into rack until mounting flanges are flush against outer side of rack-mounting strips.

(6) Secure unit in rack using appropriate size screws and suitable nut fasteners (if needed).

2.4.4 PANEL-MOUNTING PROCEDURES

CAUTION: No trim piece is supplied to cover unsightly gaps between the panel cutout and the PD-2064 front bezel when the unit is installed in place. Therefore, ensure that proper panel-cutout dimensions and cutting of straight lines are maintained.

a. Carefully make panel cutout and drill three mounting holes on each side of the cutout as illustrated in Figure 2-2.

NOTE: If mounting holes are to be threaded, a No. 16 drill (.177") and 12-24 tap are recommended. If mounting holes are not to be threaded, a 7/32" drill and 12-24 screws/nuts are recommended.

b. Support instrument and insert into front of panel cutout until mounting flanges are flush with panel.

c. Align slots in instrument mounting flanges with drilled holes in panel and mount unit using screws and nuts (if needed) applicable to the panel thickness and material.

CAUTION: Panel must be of adequate strength to support instrument. Fabricate additional rear support, if necessary.

2.5 SIGNAL CONNECTIONS

2.5.1 CONNECTION TERMINALS

a. Three different types of terminal configurations are available for making signal input connections to the input mux cards at the rear of the instrument.

b. One of the basic signal input configurations consists of a 44-pin, solder-terminal connector which mates with the edge connector of the input mux card. This type of connector may be used for virtually all types of analog input actuations (except thermocouple inputs) as well as signal connections for the digital input option. In this type of configuration, all signal inputs to the card may be quickly disconnected at one time by unplugging connector from mux card. Solder connections to the solder-terminal connector are illustrated in Figure 2-3A, B, and C.

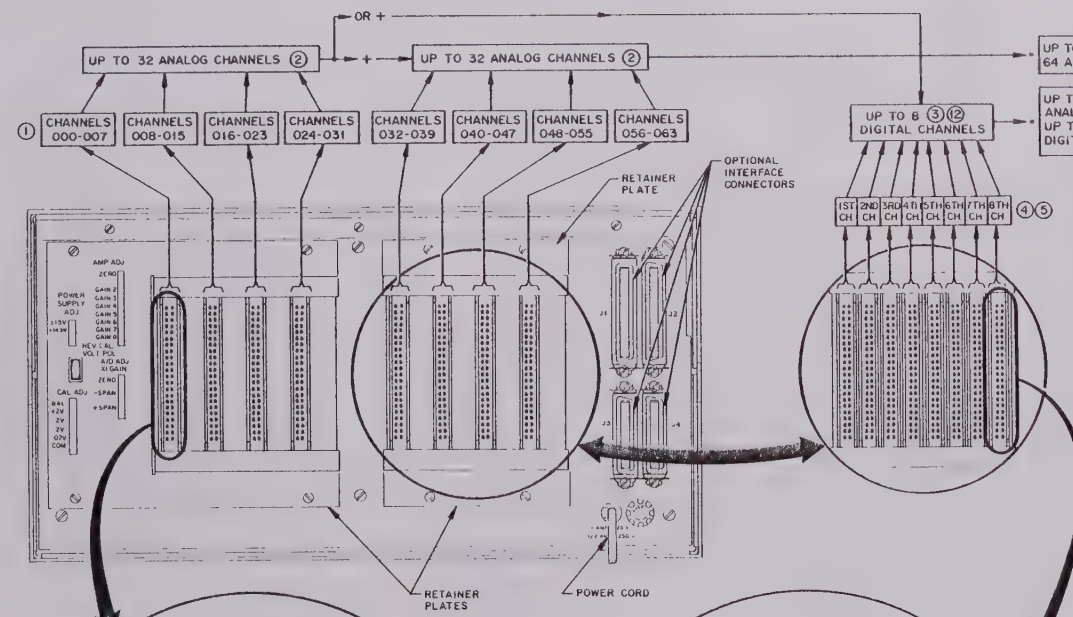
c. A second type of connector available (consult factory) is an optional screw-type terminal connector for terminating 1 mux card of analog signal inputs (except thermocouple).

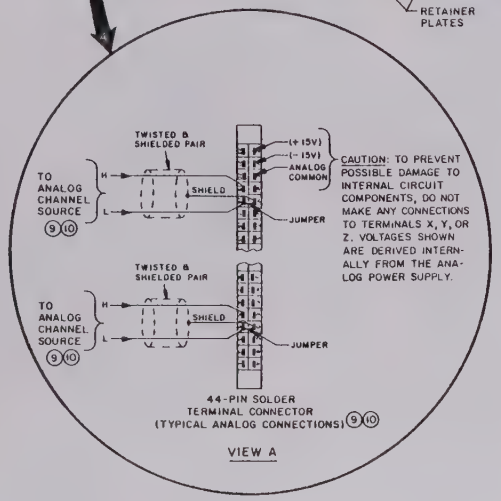
NOTE: Screw-type terminal connectors are not designed to accept signal connections from digital input sources when digital input option is included in system.

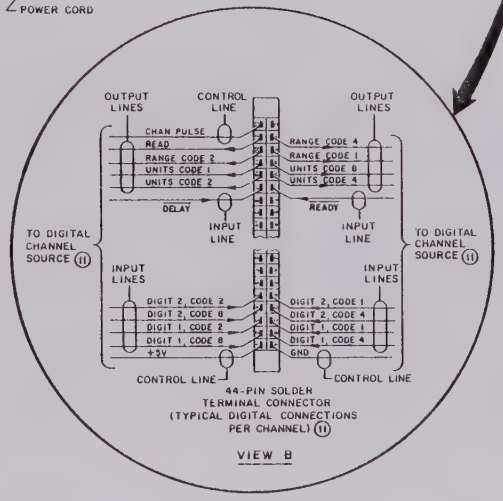
The structure of this screw-type connector consists of the solder-type connector (described above in paragraph b) which is assembled and wired to a screw-terminal board. In this configuration, the quick-disconnect feature of simultaneously removing all inputs to the card is still retained; but additional flexibility is provided by permitting each input to be either connected or disconnected independently of the others without soldering or unsoldering connections.

NOTE: Signal connections to this type of screw-terminal connector are not illustrated in Figure 2-3.

d. When system is equipped with thermocouple option, a thermally-insulated, universal analog input panel is provided with screw-type terminal blocks for signal connections. The inputs from up to four different thermocouple types may be simultaneously applied to the input panel, provided system is equipped with the required number of linearization ROMs (one linearization ROM required for each thermocouple type). The thermal input panel is specifically designed for thermocouple inputs, but may also be readily used to connect signals from virtually any other analog input source. Signal connections




TWISTED & SHIELDED PAIR
TO ANALOG CHANNEL SOURCE (9)(10)
H
L
SHIELD
(+15V)
(-15V)
ANALOG COMMON
JUMPER
CAUTION: TO PREVENT POSSIBLE DAMAGE TO INTERNAL CIRCUIT COMPONENTS, DO NOT MAKE ANY CONNECTIONS TO TERMINALS X, Y, OR Z. VOLTAGES SHOWN ARE DERIVED INTERNALLY FROM THE ANALOG POWER SUPPLY.
44-PIN SOLDER TERMINAL CONNECTOR (TYPICAL ANALOG CONNECTIONS) (9)(10)
VIEW A



ANALOG AND DIGITAL CHANNEL INPUT ARRAY USING SOLDER TERMINAL CONNECTIONS.

A

NOTES:

(1) REFER TO TABLE 2-1 FOR ANALOG CHANNEL NUMBER ALLOCATIONS.

(2) ANALOG CHANNELS ARE ADDITIVE IN MULTIPLES OF 8 CHANNELS PER ANALOG RELAY MUX CARD.

(3) DIGITAL CHANNELS ARE ADDITIVE IN INCREMENTS OF 1 DIGITAL CHANNEL PER DIGITAL MUX CARD.

(4) CHANNEL NUMBER ALLOCATIONS OF DIGITAL INPUTS PROGRESS SEQUENTIALLY FROM LEFT TO RIGHT AS VIEWED FROM REAR OF INSTRUMENT.

(5) DIGITAL CHANNEL NUMBER ALLOCATIONS ARE DEPENDENT UPON NUMBER OF ANALOG CHANNELS INCORPORATED IN SYSTEM. FIRST CHANNEL PAIR AVAILABLE FOR DIGITAL INPUTS WILL BE FIRST SEQUENTIAL CHANNEL PAIR AFTER SCAN COMPLETION OF ALL ANALOG CHANNEL INPUTS. IF NO ANALOG CHANNELS ARE INCORPORATED IN SYSTEM, FIRST DIGITAL CHANNEL PAIR AVAILABLE WILL BE CHANNELS 000 & 001 FOLLOWED SEQUENTIALLY BY A MAXIMUM OF 7 ADDITIONAL CHANNEL PAIRS (i.e., CHANNEL PAIRS 000 & 001 THRU 014 & 015).

(6) ANALOG CHANNEL DENSITIES GREATER THAN 64 (UP TO MAXIMUM OF 248) REQUIRE EXTERNAL EXPANDER PACKAGE.

(7) ANALOG CHANNEL DENSITIES GREATER THAN 32 REQUIRE EXTERNAL EXPANDER PACKAGE.

(8) SYSTEM MAY ACCOMMODATE UP TO 8 ADDITIONAL DIGITAL CHANNELS (TOTAL OF 16 DIGITAL CHANNELS MAXIMUM) HOUSED IN EXTERNAL EXPANDER PACKAGE. NOTE THAT FOR EVERY DIGITAL CHANNEL USED, MAXIMUM NUMBER OF ANALOG CHANNELS ACCOMMODATED DECREASES BY ONE.

(9) SEE CONNECTION TABLE 2-1.

(10) SEE SIGNAL CONNECTION CONFIGURATIONS IN FIGURE 2-4.

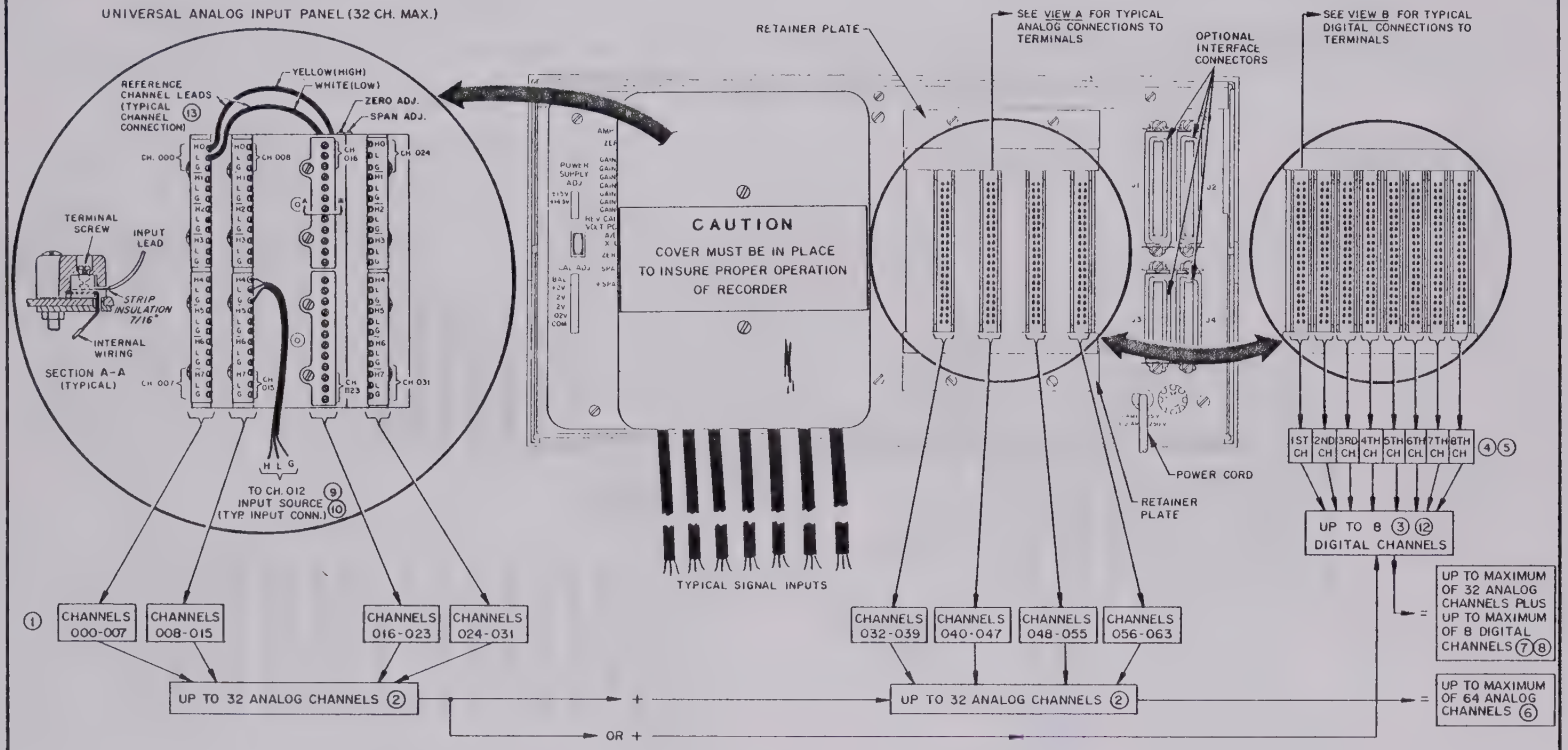
(11) SEE CONNECTION TABLE 2-2.

(12) DIGITAL INPUTS ARE OPTIONAL.

(13) USED FOR TC INPUT APPLICATIONS.

P1369-1

Figure 2-3 (Sheet 1 of 4). Typical Channel Input Configurations at Rear Panel.



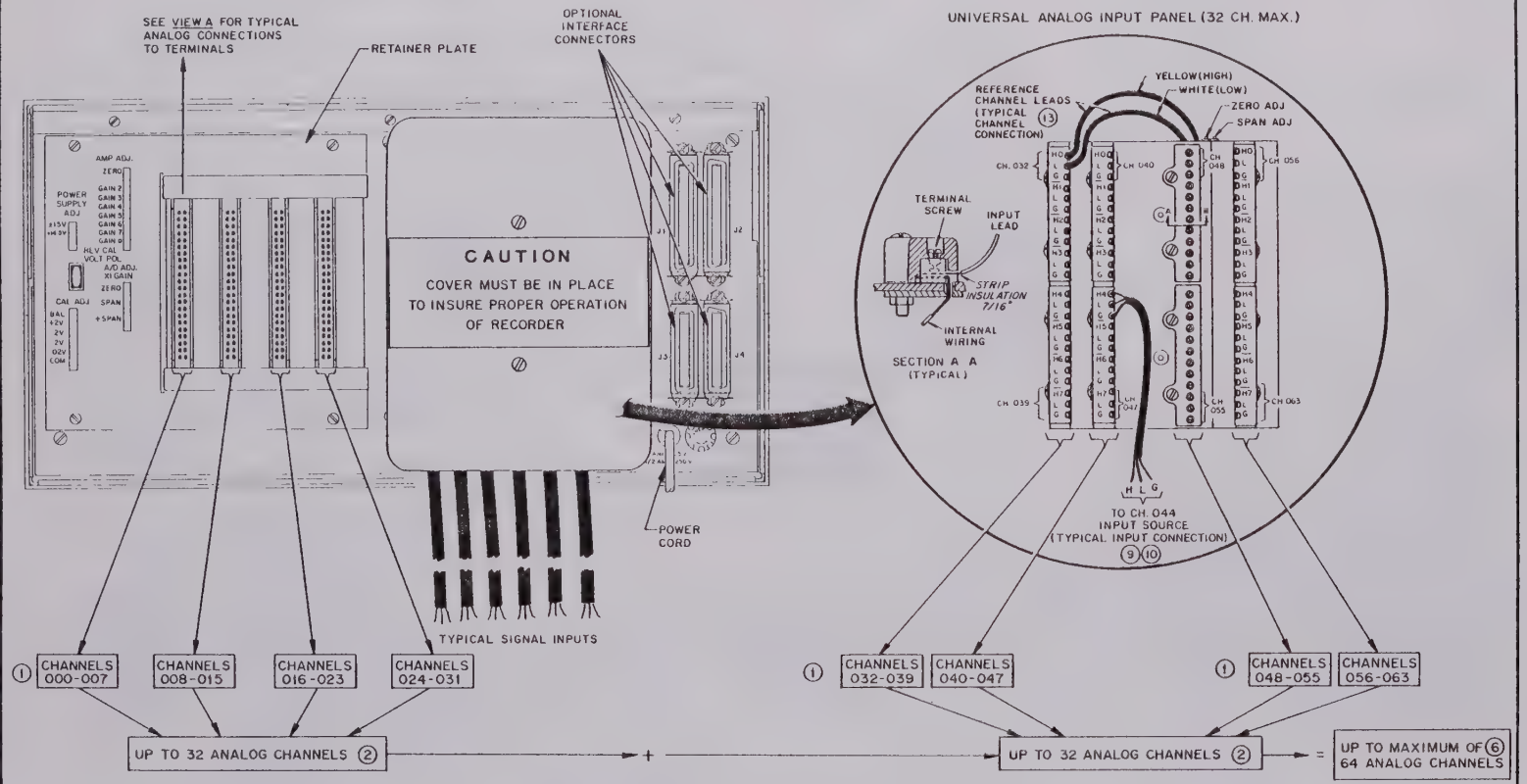
NOTE: SEE FIGURE 2-3A (SHEET 1 OF 4) FOR NOTE EXPLANATION AND VIEWS "A" AND "B".

ANALOG AND DIGITAL CHANNEL INPUT ARRAY USING 32-CHANNEL (MAX.) UNIVERSAL ANALOG INPUT PANEL AND SOLDER TERMINAL CONNECTIONS.

B

Figure 2-3 (Sheet 2 of 4). Typical Channel Input Configurations at Rear Panel.

P1369-2



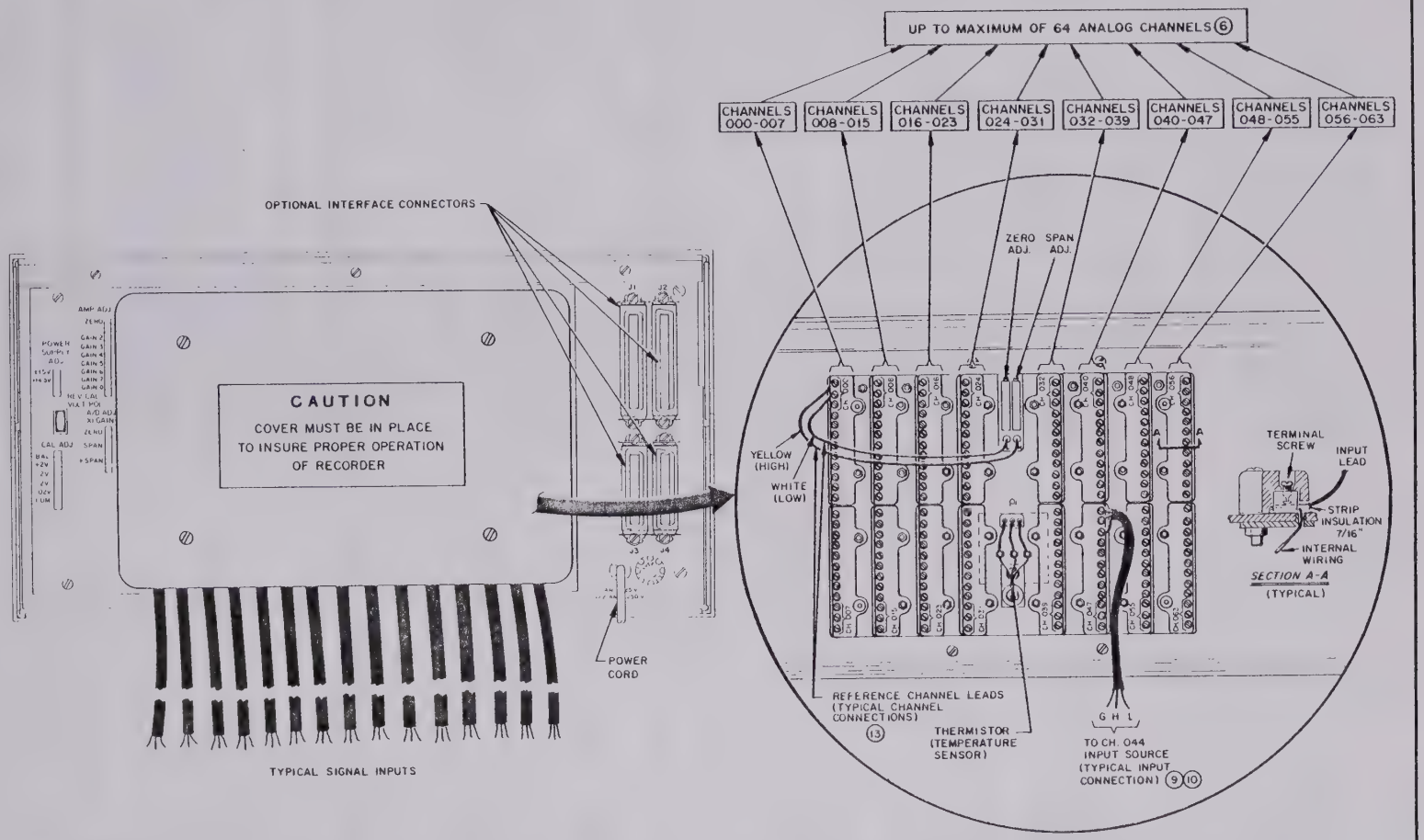
NOTE: SEE FIGURE 2-3A (SHEET 1 OF 4) FOR NOTE EXPLANATION AND VIEW "A".

ANALOG CHANNEL INPUT ARRAY USING 32-CHANNEL (MAX.) UNIVERSAL ANALOG INPUT PANEL AND SOLDER TERMINAL CONNECTIONS.

C

Figure 2-3 (Sheet 3 of 4). Typical Channel Input Configurations at Rear Panel.

P1368-1



NOTE: SEE FIGURE 2-3A (SHEET 1 OF 4) FOR NOTE EXPLANATION.

ANALOG CHANNEL INPUT ARRAY USING 64-CHANNEL (MAX.) UNIVERSAL ANALOG INPUT PANEL.

D

P1368-2

Figure 2-3 (Sheet 4 of 4). Typical Channel Input Configurations at Rear Panel.

to the input panel are illustrated in Figure 2-3B, C, and D.

NOTE: Universal analog input panel is not designed to accept signal connections from digital input sources when digital input option is included in system.

2.5.2 SIGNAL INPUT VERSUS SYSTEM REQUIREMENTS

a. If "Custom Initialization" option is used, make sure that channel numbers allocated for analog and/or digital inputs conform to system operation specifications and to alarm setpoint specifications (if "Alarm" option is used) given on the instrument Data Sheet.

b. If "Custom Initialization" option is omitted, connect analog and/or digital signals to desired channel inputs and make appropriate entries of system constants program, channel constants program, and alarm setpoint program (if "Alarm" option is included) through the instrument keyboard. Refer to "Operation" section in this manual.

2.5.3 ANALOG INPUT CONNECTIONS

a. Turn off instrument power.

b. If signal connections are to be made to the universal analog input panel, remove cover from input panel and connect signal input leads to appropriate terminals on the screw-type terminal blocks.

c. If signal connections are to be made to the 44-pin solder-terminal connector, solder leads to pins using Kester flux Type 1571 and Kirkson low-thermal, wire-type solder Grade K703 (or appropriate equivalents).

d. Refer to appropriate illustrations in Figure 2-3 and make signal connections to channel inputs as indicated in Table 2-1. Various recommended methods for connecting an analog input to a signal source are shown in Figure 2-4.

e. For signal connections made to the universal analog input panel, dress leads along bottom side of input panel so that leads can be routed through cutout in input panel cover when cover is reinstalled. For thermocouple input applications, always reinstall input panel cover after connections are made so that input terminals are kept at same ambient temperature within the enclosure.

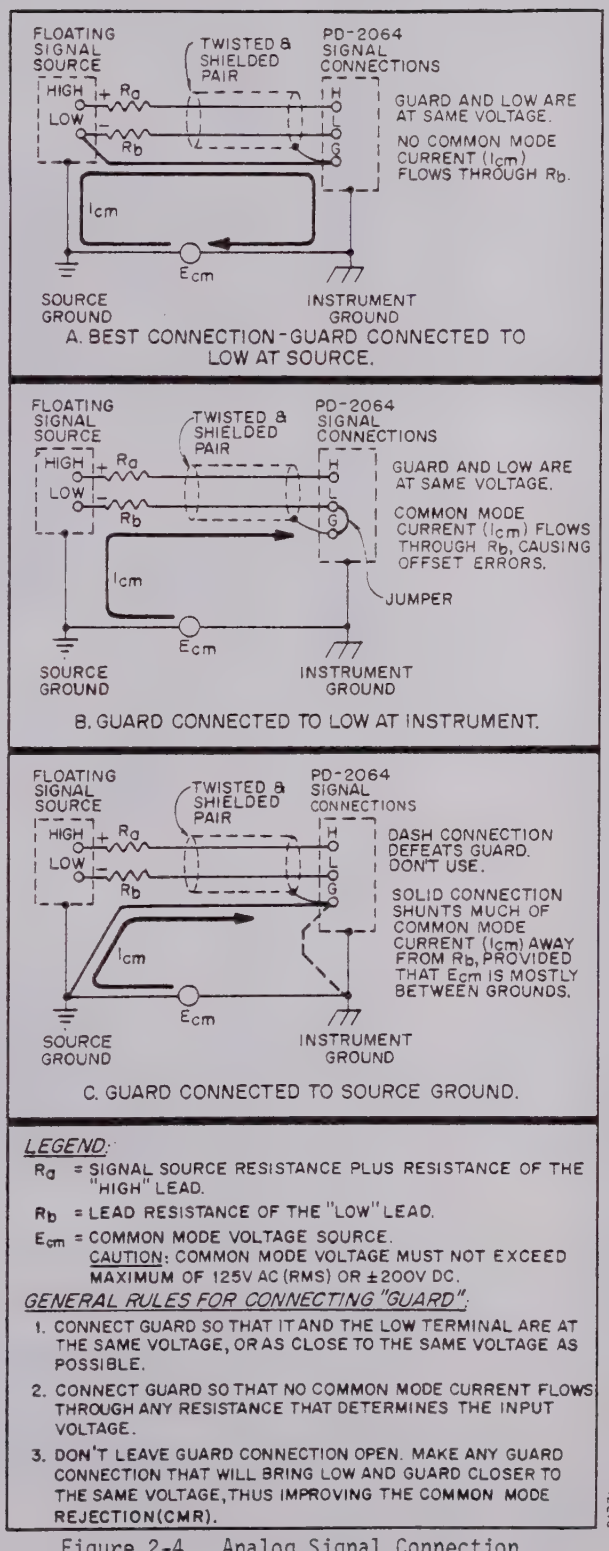

FLOATING SIGNAL SOURCE
TWISTED & SHIELDED PAIR
PD-2064 SIGNAL CONNECTIONS
HIGH
LOW
+ Ra
- Rb
H
L
G
GUARD AND LOW ARE AT SAME VOLTAGE.
NO COMMON MODE CURRENT (Icm) FLOWS THROUGH Rb.
Icm
Ecm
SOURCE GROUND
INSTRUMENT GROUND
A. BEST CONNECTION - GUARD CONNECTED TO LOW AT SOURCE.
COMMON MODE CURRENT (Icm) FLOWS THROUGH Rb, CAUSING OFFSET ERRORS.
JUMPER
B. GUARD CONNECTED TO LOW AT INSTRUMENT.
DASH CONNECTION DEFEATS GUARD. DON'T USE.
SOLID CONNECTION SHUNTS MUCH OF COMMON MODE CURRENT (Icm) AWAY FROM Rb, PROVIDED THAT Ecm IS MOSTLY BETWEEN GROUNDS.
C. GUARD CONNECTED TO SOURCE GROUND.
LEGEND:
Ra = SIGNAL SOURCE RESISTANCE PLUS RESISTANCE OF THE "HIGH" LEAD.
Rb = LEAD RESISTANCE OF THE "LOW" LEAD.
Ecm = COMMON MODE VOLTAGE SOURCE.
CAUTION: COMMON MODE VOLTAGE MUST NOT EXCEED MAXIMUM OF 125V AC (RMS) OR ±200V DC.
GENERAL RULES FOR CONNECTING "GUARD":
1. CONNECT GUARD SO THAT IT AND THE LOW TERMINAL ARE AT THE SAME VOLTAGE, OR AS CLOSE TO THE SAME VOLTAGE AS POSSIBLE.
2. CONNECT GUARD SO THAT NO COMMON MODE CURRENT FLOWS THROUGH ANY RESISTANCE THAT DETERMINES THE INPUT VOLTAGE.
3. DON'T LEAVE GUARD CONNECTION OPEN. MAKE ANY GUARD CONNECTION THAT WILL BRING LOW AND GUARD CLOSER TO THE SAME VOLTAGE, THUS IMPROVING THE COMMON MODE REJECTION (CMR).
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Figure 2-4. Analog Signal Connection Configurations.

Table 2-1. Analog Signal Input Connections[1].

CHANNEL NUMBER INPUT		TERMINAL BLOCK CONNECTIONS FOR THERMOCOUPLE OR OTHER ANALOG INPUTS	ANALOG (EXCEPT TC) INPUT TERMINAL CONNECTIONS ON 44-PIN SOLDER CONNECTOR
Ch. 000, 008, 016, 024, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 240)	H (High)	HO	PIN 19
	L (Low)	L	PIN 18
	G (Guard)	G	PIN V
Ch. 001, 009, 017, 025, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 241)	H	H1	PIN 17
	L	L	PIN 16
	G	G	PIN T
Ch. 002, 010, 018, 026, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 242)	H	H2	PIN 15
	L	L	PIN 14
	G	G	PIN R
Ch. 003, 011, 019, 027, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 243)	H	H3	PIN 13
	L	L	PIN 12
	G	G	PIN N
Ch. 004, 012, 020, 028, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 244)	H	H4	PIN 11
	L	L	PIN 10
	G	G	PIN L
Ch. 005, 013, 021, 029, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 245)	H	H5	PIN 9
	L	L	PIN 8
	G	G	PIN J
Ch. 006, 014, 022, 030, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 246)	H	H6	PIN 7
	L	L	PIN 6
	G	G	PIN F
Ch. 007, 015, 023, 031, etc. (Add constant of 008 for each additional channel number up to maximum of Ch. 247)	H	H7	PIN 5
	L	L	PIN 4
	G	G	PIN D

[1]Connections are typical for each analog input relay mux card (8 channels per card).

2.5.4 REFERENCE CHANNEL CONNECTION FOR THERMOCOUPLE INPUTS

a. For thermocouple input applications, make sure that reference channel leads are connected to the input terminals of the channel number chosen as reference.

b. Channel number chosen as the reference channel is selectable according to the system requirements and is prewired at the factory as specified on the instrument Data Sheet.

> NOTE: For thermocouple input applications, the reference channel leads should always be connected to a channel that is lower in number than any of the other channels being used for thermocouple inputs. As illustrated in Figure 2-3B and C, the reference channel leads are connected to channels 000 and 032, respectively.

c. If it is desired to select a different reference channel number in the field due to a change in system requirements, proceed as follows:

(1) Remove yellow (YW) and white (WE) leads from channel input presently being used as the reference channel.

(2) Observe notation given above under paragraph b; connect yellow (YW) lead to H (high) input terminal and white (WE) lead to L (low) input terminal of the channel number chosen as reference.

> CAUTION: No other connections of any kind should be paralleled to the input terminals of the channel number being used as the reference channel. Also, if reference channel leads are disconnected and left open for any reason (for example: discontinuance of thermocouple inputs and total input conversion to other analog input actuations), insulate ends of leads to prevent possible shorting.

OPERATIONAL NOTES:

(1) Besides the standard five digits of measurement data which appear in the display on a thermocouple channel, two additional digits of zeroes appear in the MSD and MSD-1 positions as an indication that the channel reading is in a correction function classification (class zero) assigned to thermocouple-actuated measurements. When channel data is outputted to peripheral output devices, only the zero in the MSD-1 position is recorded; the MSD zero is omitted.[1]

Display Example:[2] 00 0033.9 °C

MSD — MSD-1 — 5 DIGITS OF DATA

(2) When monitoring individual channel temperature readings via CHAN READ key on keyboard, temperatures displayed are based on the reference channel's temperature correction factor which was derived and stored in memory at the time of the last channel frame scan. To ensure that monitored data is accurate, either a manual or automatic scan should take place periodically so that the reference channel's temperature correction factor will be updated from time to time.

(3) When reference channel is being used for temperature measurements, the channel constants for the reference channel pair (or individual reference channel in single channel programming) should be programmed with the following codes:

I-O code = 1, 2, or 3 (DO NOT program with 0 code. To do so will cause reference channel to be skipped from the scanning operation and will render erroneous temperature measurements due to the absence of the reference channel's temperature correction factor.)

CORR FUNCT code = 0

RANGE code = 1

UNITS code is irrelevant.

2.5.5 OPTIONAL DIGITAL (BCD) INPUT CONNECTIONS

a. Turn off instrument power.

b. Refer to appropriate illustrations in Figure 2-3 and make signal connections to 44-pin, solder-terminal connector as indicated in Table 2-2. Solder leads to pins using a good quality, self-fluxing, multicore solder which has a composition of 60% tin and 40% lead.

c. When system incorporates both analog and digital inputs, the channels allocated for digital inputs are multiplexed in sequence after all analog channel inputs have been scanned.

---

[1] If channel data is in alarm condition, MSD-1 position is recorded as either a high alarm (:) or low alarm (.) symbol.

[2] If channel reading is in alarm condition, the MSD-1 position will read "A" for "Alarm".

Table 2.2. Digital Signal Input/Output Connections.[1]

	SIGNAL NAME	PIN NO. CONNECTION ON 44-PIN SOLDER CONNECTOR
INPUT SIGNALS[2]	DIGIT 1, CODE 8	2
	DIGIT 1, CODE 4	B
	DIGIT 1, CODE 2	3
	DIGIT 1, CODE 1	C
	DIGIT 2, CODE 8	4
	DIGIT 2, CODE 4	D
	DIGIT 2, CODE 2	5
	DIGIT 2, CODE 1	E
	DIGIT 3, CODE 8	6
	DIGIT 3, CODE 4	F
	DIGIT 3, CODE 2	7
	DIGIT 3, CODE 1	H
	DIGIT 4, CODE 8	8
	DIGIT 4, CODE 4	J
	DIGIT 4, CODE 2	9
	DIGIT 4, CODE 1	K
	DIGIT 5, CODE 8	10
	DIGIT 5, CODE 4	L
	DIGIT 5, CODE 2	11
	DIGIT 5, CODE 1	M
	DIGIT 6, CODE 8	12
	DIGIT 6, CODE 4	N
	DIGIT 6, CODE 2	13
	DIGIT 6, CODE 1	P
	DIGIT 7, CODE 8	14
	DIGIT 7, CODE 4	R
	DIGIT 7, CODE 2	15
	DIGIT 7, CODE 1	S
	$\overline{\text{COMP}}$ (OUT)	16
	$\overline{\text{COMP}}$ (IN)	T
	DELAY	17
	$\overline{\text{READY}}$	U
OUTPUT SIGNALS	UNITS CODE 2	18
	UNITS CODE 4	V
	UNITS CODE 1	19
	UNITS CODE 8	W
	RANGE CODE 2	20
	RANGE CODE 1	X
	READ	21
	RANGE CODE 4	Y
CHAN PULSE		22
+5V (100mA max.)		1
DIGITAL GROUND		A

[1] This connection table is representative of the standard digital input program. See appropriate supplementary instructions covering connections for optional digital input programs. Connections are typical for each digital input mux card (one channel per card).

[2] Configuration of input signals may consist of 7 digits of BCD numeric data plus 1 digit for data control (i.e., $\overline{\text{COMP}}$(OUT), $\overline{\text{COMP}}$(IN), DELAY, $\overline{\text{READY}}$); or the total of 7 input digits may be divided into 5 digits of BCD numeric data, plus 1 digit for the sign data, plus 1 digit for condition of data(i.e., normal data, overrange, low alarm, high alarm, or default), plus the digit for data control.

P1497A

EXAMPLE: If system requirements specified 32 analog channel inputs and 8 digital channel inputs, the multiplexing system first scans all analog inputs (channels 000 thru 031) and then secondly scans the digital inputs (channels 032 through 039).

d. When combining analog and digital inputs in the same system, the first available channel pair that can be allocated for digital inputs is the next consecutive channel pair after scan completion of all analog channel inputs. Once the first digital channel input has been scanned, all subsequent digital channel inputs are sequentially scanned (up to maximum of 16 digital channel inputs).

> NOTE: Scanning of channel inputs cannot be alternated between analog and digital inputs. All analog channels are scanned first; then all digital channels are scanned.

e. If system incorporates only digital channel inputs, the first available channel input is channel 000 with subsequent channels scanned in sequence (i.e., channel 000 up to maximum of channel 015).

f. For ROM (ROM 15) instructions governing the operation of the standard digital input program, refer to paragraph C.2.3 in "Section C" of the Appendix.

OPERATION

SECTION 3 - OPERATION

3.1 GENERAL

a. After the PD-2064 data system has been installed and channel inputs connected, the next step is to place the system in operation. Operation of the system is controlled by the front-panel keyboard.

b. The PD-2064 has been designed for simplicity in keyboard programming, and most operators will be able to learn the basic programming procedures in about 2 to 3 hours. Familiarization with the programming organization and operations may best be understood by referring to subsequent information in this section.

3.2 OUTPUT DEVICE DESCRIPTION AND OPERATION

For information regarding the optional output devices that may be used in the system, refer to Section B in the "Appendix" of this manual.

> NOTE: Before system is placed in operation, make sure that interconnections to external peripheral device(s) have been properly made. Also, refer to operating instructions supplied by equipment manufacturer of peripheral device. As a precautionary check on possible dislodgment of the printer's ribbon transport mechanism during shipment or handling, make sure that ribbon attachment is firmly seated in its detented position (fully rearward) atop the printer to ensure proper printing results. Load printer paper as indicated under paragraph B.3.1.4 in "Section B" of manual.

3.3 PD-2064 KEYBOARD

Before attempting to operate the instrument, refer to Figure 3-1 for a functional description given of each key on the keyboard and other front-panel components.

3.4 PROGRAMMING THE PD-2064

The PD-2064 should be programmed to operate in conformance with system requirements as specified on the instrument Data Sheet, or as otherwise desired. The PD-2064 system configuration and program specification codes are indicated on the Data Sheet and on "Side 2" of the programming guide (see paragraph 3.4.4). Refer to sheet 1 of Figure 3-2 for a breakdown of the start-up procedures.

3.4.1 KEYBOARD TOUCH

a. As with any keyboard device, the operator must become accustomed to the feel of the keys for optimum operating efficiency. When entering or checking various programs with the keyboard, observe display to confirm that correct entries are being made or that customized programs already in memory are correct. If keying errors are made while programming, simply press the CLEAR ENTRY key and reprogram correctly. Programming errors caused by improper manipulation of the keys may cause improper operation but will not damage the instrument.

b. A few pointers in finger-tip control of the keys are given as follows:

(1) Keys should be fully depressed with firmness and without hesitation. Do not try to actuate key by a jabbing or pecking motion.

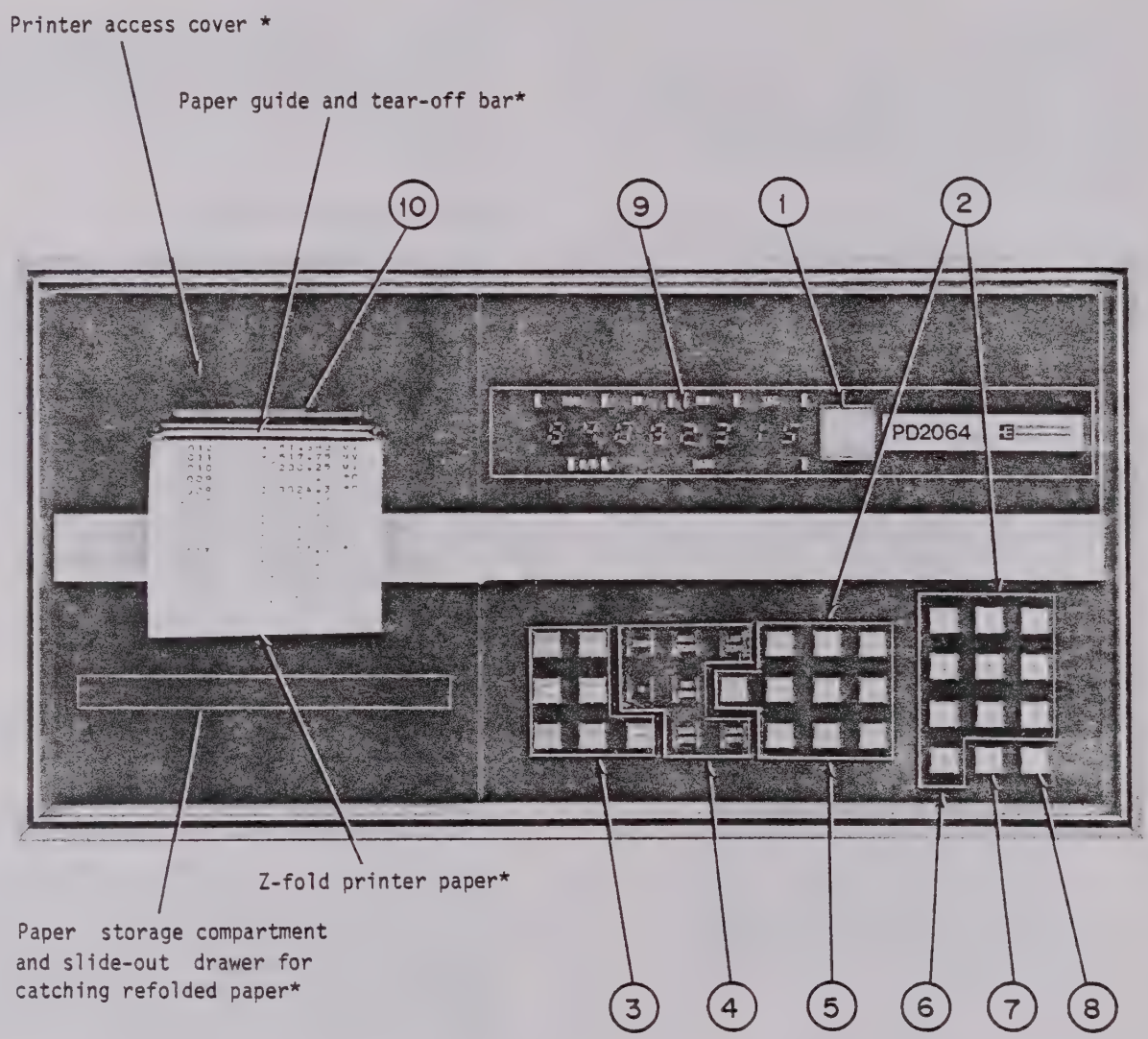
(2) As soon as key has reached its innermost travel, key should be released. Do not continually hold key down.

3.4.2 SIMPLIFIED OPERATIONAL FLOWCHART

A simplified overview of the programming operations is shown in the flow chart of Figure 3-2. The programming sequence starts with the instrument turned off. The heirarchical operations then logically flow downward to: (1) control system operation, (2) set the system constants program, (3) select channels and set the channel constants program, and (4) set the channel alarm setpoints program when "Alarm" option is used.

3.4.3 OPERATIONAL FLOW DIAGRAM FOLDOUTS

a. Two fold-out sheets ("PD-2064 Operational Flow Diagram and Keyboard Programming") are provided in this section of the manual to graphically illustrate the operational flow sequence for systematically programming the PD-2064. The operational flow diagram gives a detailed step-by-step analysis of the simplified flow chart shown in Figure 3-2.



* These components are only affiliated with the internally-mounted Seiko printer output device option. See description of component (10)

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(1) Power Switch: Push-push type. Turns instrument on and off. Pushbutton lights up red in "on" position. System turns on to "Automatic Mode" without necessity of pressing AUTO key. See description under AUTO key for functional aspects of "Automatic Mode."

(2) Keyboard: Instrument keyboard is used to control system operation and to program the various data entry functions. Keyboard is arranged into 4 distinct groups of color-coded keys, with each group assigned to particular programming functions. Functional description of keys in each group follows. See descriptions (3), (4), (5), (6), (7), and (8). As a special option, keyboard (2) and display (9) are mounted in a separate enclosure for remote operation of the system (see Section D in the "Appendix" of this manual). Interconnection between the remote unit and instrument is made through a standard length cable of 20 feet. Cable lengths longer than 20 feet are available. Consult factory.

(3) Seven red keys control system operation:

READY: Closes a switch. Reserved for custom requirements (i.e., mag tape control).

FWD: Used to advance paper through paper transport mechanism of Seiko printer output device option. Advances paper one step at a time for each depression of key. Holding key depressed permits paper to be manually pulled from printer. Normally used when loading printer paper or when it is desired to advance paper so that certain data can be torn off as a complete record. Key can perform same type function for other custom output device options.

REV: Closes a switch. Reserved for custom requirements (i.e., mag tape reverse control).

AUTO: Enables switching from "Input Mode" to "Automatic Mode." In "Automatic Mode," system automatically scans, measures, and outputs as programmed; display and keyboard are disabled, and system conserves power between data scans by interrupting power to output devices. See description under INPUT key for functional aspects of "Input Mode."

INPUT: Enables switching from "Automatic Mode" to "Input Mode." In "Input Mode," system becomes completely operational. Power is applied to all circuits, display is turned on, and keyboard is activated to receive programming instructions.

HALT: Stops current channel scan and output operations while system is engaged in either the "Automatic" or "Input" mode. Cancels occurrence of the next channel frame scan and output by automatically resetting NEXT SCAN time to zero. To resume scan operations after a HALT function, new NEXT SCAN time must be reprogrammed. See description for NEXT SCAN key.

MAN REC: Manually starts an immediate scan and output of one data frame. Temporarily overrides NEXT SCAN time setting. For additional functions of MAN REC key when optional features are included, refer to keyboard programming Sections 1.3.2, 1.3.3, and 1.3.4 on "PD-2064 Operational Flow Diagram" foldout.

(4) Seven black keys select system constants:

TIME: Key displays real or elapsed time in days, hours, minutes, and seconds. Must be actuated before setting time with numeric (6) and ENTER (8) keys.

ID: Key displays frame identification number and other special mode control code functions. Key initiates procedures to change frame identification number and special function codes. See special mode control functions in keyboard programming Sections 1.2.1 and 1.2.2 on "PD-2064 Operational Flow Diagram" foldout.

NEXT SCAN: The time set for the next scan is displayed in days, hours, minutes, and seconds when this key is pressed. Key initiates procedures to change or establish a new next scan time with numeric (6) and ENTER (8) keys.

REF CHAN: Key displays the number of the channel chosen as reference in a predesignated block of channels. It may be used as a two-digit pointer that tells the central processing unit (CPU) the location of channels within a binary block that have been hard wired for a specific function. Example 1: the reference channel may be used to supply a common denominator in ratio or comparative measurements. Example 2: For thermocouple measurements, channel 0 is chosen as reference channel in a block of channels.

SCAN INTVL: Key displays the time interval setting between data scans in days, hours, minutes, and seconds. Setting is changed by entering new time with numeric (6) and ENTER (8) keys.

LAST SCAN: Key calls from memory and displays time of last data scan in days, hours, minutes, and seconds.

CHAN INTVL: Key displays the time delay interval in seconds between measurements of individual channels. Channel interval is settable between 0 and 99 seconds with numeric (6) and ENTER (8) keys.

(5) Ten gray keys: (a) select channel numbers and channel constants, (b) select channel setpoints for alarm option, (c) monitor channel data, and (d) provide entry of negative numeric values.

NOTE: See channel constant codes in Table 1 on "PD-2064 Operational Flow Diagram" foldout. For group (block) programming of channel constants and alarm setpoints, see paragraph 3.5.6.

CHAN SELECT: Key displays the channel number which is currently being addressed and permits alarm setpoints program and channel constants program to be entered into memory. Alarm setpoints program is entered on an individual channel basis; whereas, channel constants program is entered on a channel pair basis (channel pairs start with even numbers).

NEXT CHAN: Used as a programming shortcut. Key selects currently addressed channel number plus next sequential channel number and permits alarm setpoints program and channel constants program to be entered into memory. Programs are entered on same channel basis as given for CHAN SELECT key.

CHAN READ: Key places system on real time at one measurement per second and displays monitored value of selected channel. Refer to keyboard programming Section 3.2 on "PD-2064 Operational Flow Diagram" foldout.

I-O: Key displays the prevailing channel constant input-output code from memory for channel pair selected. Existing I-O code is changed with numeric (6) and ENTER (8) keys.

CORR FUNCT: Key displays the prevailing channel constant correction function code from memory (such as thermocouple and/or alarm correction function) for channel pair selected. Existing correction function code is changed with numeric (6) and ENTER (8) keys.

RANGE: Key displays the prevailing channel constant range code from memory for channel pair selected. Existing range code is changed with numeric (6) and ENTER (8) keys.

UNITS: Key displays the prevailing channel constant units code from memory for channel pair selected. Existing units code is changed with numeric (6) and ENTER (8) keys.

HIGH ALARM: Key displays the prevailing 5-digit high alarm setpoint value from memory for individual selected channel. Existing alarm setpoint is changed with numeric (6) and ENTER (8) keys. HIGH ALARM key is also used to control system operation as given in keyboard programming Sections 1.2.1 and 1.3.3 on "PD-2064 Operational Flow Diagram" foldout.

LOW ALARM: Key displays the prevailing 5-digit low alarm setpoint value from memory for individual selected channel. Existing alarm setpoint is changed with numeric (6) and ENTER (8) keys. LOW ALARM key is also used to control system operation as given in keyboard programming Sections 1.2.1 and 1.3.2 on "PD-2064 Operational Flow Diagram" foldout.

MINUS: Permits entry of negative numeric values and controls certain aspects of system operation as described under keyboard programming Sections 1.2.2 and 1.3.2 on "PD-2064 Operational Flow Diagram" foldout. Also used in group (block) programming of channel constants and alarm setpoints as given under paragraph 3.5.6.

(6) Ten white keys (0-9) set integer or fixed decimal entry of channel numbers, codes, and data.

(7) CLEAR ENTRY: Key cancels numeric values in case of keying mistake. Works like CLEAR ENTRY on a calculator.

(8) ENTER: Commands central processing unit (CPU) to accept data from display and stores data in memory after each program operation.

(9) DISPLAY: Eight-digit light emitting diode (LED) display reads out time or data as directed by the keyboard. Direct 4.4 digit display gives time in days, hours, minutes, seconds (to 99 days, 23 hours, 59 minutes, 59 seconds). Floating decimal point and minus (-) polarity indications are displayed on data. Positive (+) polarity sign is implied and not indicated. Overrange values are indicated by a letter L preceding the data. As a special option on slow-scan systems, a program can be furnished to give an alternating display of channel number and channel data for each channel addressed (consult factory).

(10) DIGITAL PRINTER: An internally-mounted Seiko 21-column printer may be employed as one of six optional output devices. Any two of six output devices may be interfaced to the PD-2064 at the same time. See Section B in the "Appendix" of this manual for listing of optional output devices.

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Figure 3-1. Functional Description of PD-2064 Front Panel Components.

RATION

PROCEDURE I — SYSTEM START-UP PROCEDURES WITH "CUSTOM PROGRAM INITIALIZATION" OPTION.

a. If your system is equipped with the "Custom Program Initialization" option, it will be so indicated by a check mark (✓) in the table which lists the system's selectable features and options (located at front of manual). For description of this option, refer to paragraph 3.5.1.

b. The custom program initialization specified by the user at time of instrument order is entered on as many as two separate custom initialization forms. The "System Operation Specification" form lists the programs for the system constants and channel constants. The pre-programmed system constants consist of: reference channel number (REF CHAN), frame identification number (ID), channel scan interval time (CHAN INTVL), starting time (TIME), system scan interval time (SCAN INTVL), and next scan time (NEXT SCAN). The pre-programmed channel constants consist of: channel input and output functions (I-O), channel correction functions (CORR FUNCT), channel gains (RANGE), and channel units (UNITS). If the "Alarm" option is included in the system and the user has specified custom initialization of the alarm setpoints, the "Alarm Setpoint Specification" form lists the program for the alarm setpoints. The appropriately filled-out specification form(s) are found in the "Technical Data" envelope at rear of manual.

c. START-UP PROCEDURES: Typical start-up procedures are given as follows:

(1) Press power key (key lights up). If keylock[1] option is used, insert key in keylock and turn lock to clockwise position. Press INPUT key to confirm application of power. Refer to information regarding "CONFIRM APPLICATION OF POWER" block on page 3-5. After power has been confirmed, press AUTO key to engage "Automatic Mode" of operation. If, at this point, operator does not wish to check or change the custom initialized programs that are stored in memory, complete the start-up procedures by referring to Step 2. If checks or changes of the programs are desired, proceed with Steps 3 through 7.

(2) In "Automatic Mode" the system scans, measures, and outputs data according to the custom programs stored in memory. Also refer to information regarding "AUTOMATIC MODE" block on page 3-5. If it is desired to stop the scanning and output functions while system is engaged in "Automatic Mode" without turning power off, press HALT key. Pressing HALT key automatically resets the next scan time to zero and prevents future scans from occurring. To resume programmed functions in "Automatic Mode" after halting, first press the INPUT key to engage "Input Mode" of operation; and then reprogram the desired next scan time by following keyboard entry procedures described under PROCEDURE II. After next scan time has been reprogrammed, re-engage "Automatic Mode" by pressing AUTO key. If it is desired to lock instrument in the "Automatic Mode", turn keylock (if used) to the counterclockwise (vertical) position. To turn instrument off, refer to Step 7.

(3) Press INPUT key to engage "Input Mode" of operation (display reads all L's). In "Input Mode", the system scans, measures, and outputs data according to the custom program initialization. Also, refer to information regarding "INPUT MODE" block on page 3-5. If it is desired to stop the scanning and output functions while system is engaged in "Input Mode" without turning power off, press HALT key. Pressing HALT key automatically resets the next scan time to zero and prevents future scans from occurring. To resume programmed functions in "Input Mode" after halting, press NEXT SCAN key and reprogram the desired next scan time by following keyboard entry procedures described under PROCEDURE II.

(4) With system engaged in "Input Mode", check custom programs as specified on the custom initialization forms. If "Program Printout" option[2] is used, the system constants program and channel constants program (as entered on the "System Operation Specification" form) may be checked by pressing the MINUS key, and then the MAN REC key. The system constants program and channel constants program are then delivered to the output device(s). A typical printout example of a channel program frame is shown in Fig. 2 on the right-hand, fold out sheet of the operational flow diagram (located at end of Section 3). If the optional alarm setpoint program is specified for the system, the program entered on the "Alarm Setpoint Specification" form may also be checked by pressing either the HIGH ALARM or LOW ALARM key, and then the MAN REC key. The alarm setpoints program is then delivered to the output device(s). A typical printout example of an alarm setpoints program is shown in Fig. 3 on the right-hand, fold-out sheet of the operational flow diagram. If the "Program Printout" option is omitted from system, the custom program initialization may be checked on the display by following procedures given in Table 2 on the right-hand, fold-out sheet of the operational flow diagram.

(5) If it is desired to change any of the custom programs, keep "Input Mode" engaged and follow keyboard entry procedures as described under PROCEDURE II.

(6) After programs have been checked and desired changes made, either retain "Input Mode" of operation or select the "Automatic Mode" by pressing AUTO key. If keylock option is used, refer to operational aspects given in paragraph D.3 in "Section D" of manual.

(7) To turn instrument off, press power key (power key light goes off).

NOTE: When changes are made to a custom initialized program by keyboard entries in the field, the field-programmed entries will be erased from memory upon instrument "turn-off"; and the custom programs revert to their original custom pre-programmed initialization when instrument is turned back on.

PROCEDURE II — SYSTEM START-UP PROCEDURES WITHOUT "CUSTOM PROGRAM INITIALIZATION" OPTION.

a. If your system is not equipped with the "Custom Program Initialization" option, the desired program specifications for the system constants, channel constants, and optional alarm setpoints are entered through the instrument keyboard.

b. START-UP PROCEDURES: Typical start-up procedures are given as follows:

(1) Press power key (key lights up). If keylock[1] option is used, insert key in keylock and turn lock to clockwise position. Press INPUT key to engage "Input Mode" of operation. Display should read all L's. If display remains blanked out, press power key "off" and "on"; and then press INPUT key again. Display should read all L's. If display still remains blanked out, repeat process of turning instrument "off" for a few seconds, back "on", and then pressing INPUT key until display reads all L's. Process should not have to be repeated more than once or twice.

(2) With system engaged in "Input Mode", enter desired programs through keyboard to conform with application requirements. For a better understanding, it is suggested that the operator turn to the programming example given under paragraph 3.5.8 in this section of the manual. This example leads the operator through the various program entries by using the operational flow diagram fold-outs described in paragraph 3.4.3.

(3) If it is appropriate to group (block) the programming of channel constants and optional alarm setpoints, refer to procedures under paragraph 3.5.6.

(4) If the channel constant correction function coding for a particualr channel (or channel pair) requires either a single character or 2-character correction function code (except "0" or "0A" code), the keyboard entry of such code sets the special correction function and, in addition, automatically programs the appropriate range code and units code for the selected channel(s). For example, if the system is equipped to measure Type K [0]F thermocouple inputs, entering the single character correction function code of "3" for the appropriate channels also automatically sets the range code to "5" and the units code to "2" on these channels. In the case of a 2-character correction function code, such as "3A", entering of code "3A" produces same programming results as above with an additional "alarm detection" correction function (A) being applied to the selected channel(s). See instrument Data Sheet for appropriate channel constant programming codes.

NOTE: Even in systems that do not employ special correction function circuits (ROMs), keyboard entry of either a single character or 2-character correction function code (except "0" and "0A") automatically alters the existing in-storage range code and units code to some other random codes. If these codes are inappropriate for the selected channels, the desired range and units codes are then appropriately entered through the keyboard.

(5) If thermocouple inputs are included in the system configuration, the reference channel(s) in channel pair or single channel programming systems should be programmed with the following codes: I-O code[3] = 1, 2, or 3; CORR FUNCT code = 0; RANGE code = 1; and UNITS code is irrelevant.

(6) After desired programs have been entered through the keyboard and the programs checked (per procedures in programming example under paragraph 3.5.8), either retain "Input Mode" of operation or select the "Automatic Mode" by pressing the AUTO key.

(7) In "Input Mode" system scans, measures, and outputs data according to the programs that were entered through the keyboard. Also refer to information regarding "INPUT MODE" block on page 3-5.

(8) In "Automatic Mode", the system similarly scans, measures, and outputs data according to the programs that were entered through the keyboard. Also refer to information regarding "AUTOMATIC MODE" block on page 3-5.

(9) If keylock option is used, refer to operational aspects given in paragraph D.3 in "Section D" of manual.

(10) To turn instrument off, press power key (power key light goes off).

NOTE: Turning instrument power off erases programs that have been entered in memory via the keyboard. When power is reapplied to the instrument, system automatically reverts to an initialized programmed state as given in Table 2 on the right-hand, fold-out sheet of the operational flow diagram. The program constants indicated in Table 2 are the ones initialized when the "Custom Program Initialization" option (see paragraph 3.5.1) is not used.

[1]For operational aspects of keylock, refer to paragraph D.3 in "Section D" of manual.

[2]For description of this option, refer to paragraph 3.5.2.

[3]DO NOT program the I-O code with a zero (skip) function). To do so will cause skipping of the reference channel, thus rendering erroneous temperature measurements due to the absence of the reference channel's temperature correction factor.

Figure 3-2 (Sheet 1 of 2). PD-2064 Start-up Procedures.

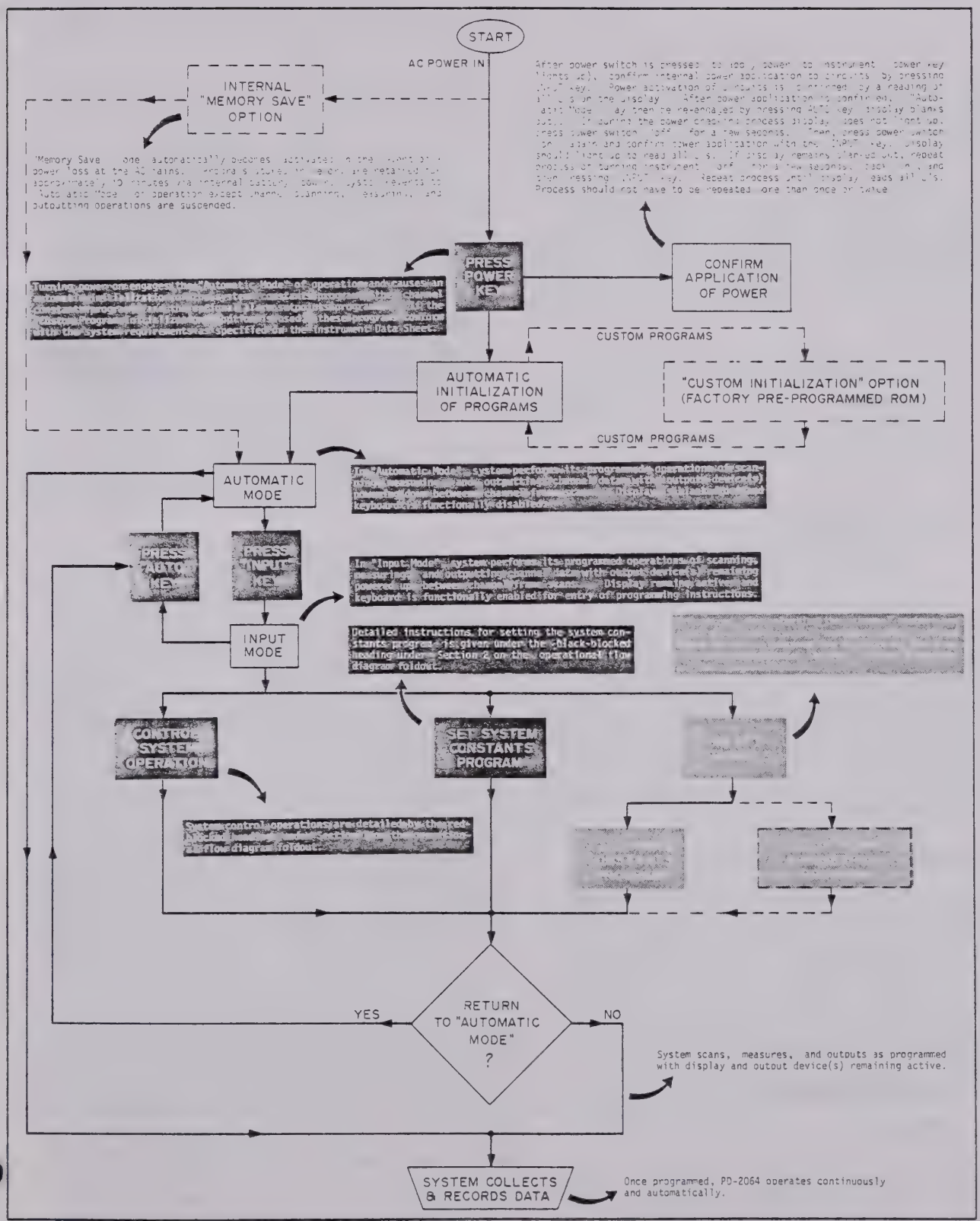


Figure 3-2 (Sheet 2 of 2). Simplified Programming Flow Chart.

Refer to these two foldouts for a comprehensive guide in learning the programming principles. A condensed version of the programming principles is given on a handy programming guide (see paragraph 3.4.4).

b. The left-hand foldout sheet of the operational flow diagram gives a color-keyed presentation of operations which correlate the keyboard, the desired keyboard function and the corresponding programming procedures required to perform each function as directed by the flow routes.

c. Explanation of the color code is as follows:

Red = keys, keyboard functions, and programming procedures for controlling system operations.

Black = keys, keyboard function, and programming procedures for selecting system constants.

Gray = keys, keyboard functions, and programming procedures for selecting channel numbers, channel constants, and optional channel alarm setpoints.

d. The right-hand foldout sheet gives: (1) an explanation of the triangular-marked notes (i.e., ⚠1) that are encountered in the programming procedures on left-hand foldout sheet; (2) check-out procedure for displaying automatically initialized system constants, channel number, channel constants, and channel alarm setpoints (without "Custom Initialization" option) in Table 2; and (3) printout examples from Seiko printer output device option. Printouts are correlated with programming procedures on left-hand foldout sheet.

3.4.4 SIMPLIFIED PROGRAMMING GUIDE

A simplified and condensed version of the PD-2064 keyboard programming is contained on a programming guide (Figure 3-3) found in the envelope at the back of this manual. Instructions outlining its use are given on each side of the guide.

3.5 PROGRAMMING OPTIONS AND SYSTEM FEATURES

3.5.1 "CUSTOM PROGRAM INITIALIZATION" OPTION

a. The "Custom Initialization" option is used in system requirements where it is desirable to store the entire program and thus safeguard the program against loss or accidental tampering.



Figure 3-3. Programming Guide Summarizes Basic Operations.

Examples of its use are in systems primarily applied to a dedicated task or in systems with complex or lengthy programs.

b. Custom initialization may be provided for the system constants program, the channel constants program, and the alarm setpoints program.

c. The custom initialization instructions for the system constants and channel constants programs are contained in ROM 4 position on the CPU card (see Figure 1-3 and Table 1-1). The ROM 4 instructions are pre-programmed at the factory to comply with the program initialization specified by the user.

d. In addition to the system constants and channel constants program initialization, a custom initialization of the alarm setpoints program may also be provided in systems that incorporate the "Alarm" option. The custom initialization instructions for the alarm setpoints program are contained in a separate ROM which may occupy any vacant ROM position from ROM 10 through ROM 13 on the CPU card (see instrument Data Sheet for specific location). The instructions for this ROM are pre-programmed at the factory to comply with the alarm setpoint initialization specified by the user.

e. To ensure that the desired program is stored in the custom initialization ROM, any or all of the program constants may be viewed on the display by following check-out procedures in Table 2 on the right-hand foldout sheet of the operational flow diagram. If the "System Constant Printout" ("Program Printout") option is used (see paragraph 3.5.2), the custom program may be outputted to the output device(s) for verification.

f. The keyboard may be used to modify any custom ROM instruction. For example, if it is desired to change any of the customized pre-programmed

constants in the field, new constants may be entered into the overall program by keyboard programming.

> NOTE: When changes are made to a factory pre-programmed ROM by keyboard programming in the field, the field-programmed constants will be erased from memory upon instrument shutdown; and the ROM instructions revert back to the original factory pre-programmed initialization.

g. One custom pre-programmed ROM may be exchanged for another pre-programmed ROM containing a completely different program by simply unplugging the existing ROM and plugging in the new one.

h. The main benefits of the "Custom Initialization" option saves programming time by reducing operator involvement, saves program during extended periods of instrument shutdown, and guards against fixed-program obsolescence via the keyboard override feature.

3.5.2 "SYSTEM CONSTANT PRINTOUT" ("PROGRAM PRINTOUT") OPTION

a. This option permits the user to obtain a printed (or recorded) listing of the system's programmed parameters via the output device(s) connected to the data system. The parameters outputted consist of the system constants program, the channel constants program, and the optional alarm setpoints program. The instructions for this option are stored in a ROM which plugs into its designated slot on the CPU card (see Figure 1-3).

b. Use of this feature permits a quicker and more convenient way of verifying the entire stored program than when verifying the program with the display. Additionally, it provides a permanent record that can be saved and then later used for re-entry of a particular program.

c. Programming procedures involving this option are given in keyboard programming Sections 1.3.2, 1.3.3 and 1.3.4 on the left-hand foldout sheet of the operational flow diagram. Resulting printout examples from the optional Seiko printer output device are shown in Figures 2 and 3 on the right-hand foldout sheet of the operational flow diagram.

3.5.3 "ALARM" OPTION

a. This option provides a means of detecting and indicating an alarm condition whenever the analog or digital channel input values are not within predetermined limits as defined by the alarm setpoints program.

b. Alarms operate on a digital comparison basis. Digitized input data for programmed channels are compared with their digitized alarm setpoint values. Logic operates when limits are exceeded, and the channels in alarm are indicated in the output record.

c. The control instructions for the "Alarm" option are stored in a ROM which plugs into its designated slot on the CPU card; whereas, the alarm setpoints are stored in RAM locations on the CPU card and/or the RAM expansion card (see Figure 1-3).

d. Total RAM storage capacity (31 RAMs) is shared between the number of signal input channels and the number of alarm setpoints as given by the breakdown in Table 3-1.

3.5.3.1 ALARM PROGRAM ENTRY

The alarm setpoints are entered into memory (RAM) on an individual channel basis. The desired setpoint program may be entered from the keyboard or automatically programmed into memory (RAM) via instructions contained within an optional factory-preprogrammed custom initialization ROM. See description of "Custom Program Initialization" option in paragraph 3.5.1.

3.5.3.2 "PRINT-ON-ALARM" OPTIONS

The alarm program provides one of two different print-on-alarm options as follows:

a. POA OPTION: This option provides the basic print-on-alarm (POA) function which may be operated in either one of the following two ways:

(1) In one mode of operation, channels are continuously scanned at the programmed channel

interval rate, and channel data is outputted at the programmed scan interval rate even though no channels are in the alarm condition. However, should any of the channels that are continuously being scanned be detected in an alarm condition, an output of a complete channel frame scan is triggered from memory. In this manner, the system is effectively provided with the feature of an "alarm scan and output" at one rate and "scan on interval and output" at another rate.

(2) The second mode of operation functions similarly to the first mode except that a channel frame is outputted only when a channel is detected in an alarm condition. In this mode, the "next scan" time is functionally inhibited by entering all zeroes (00000000) or all minuses (--------) for the "next scan" time. Consequently, a channel frame will only be outputted when triggered by an alarm condition that is detected on any of the channels that are continuously being scanned.

b. POCAS OPTION: This option, termed "Print-Only-On-Change-of-Alarm Status, is similar to the POA option except that a complete channel data frame is outputted whenever any channel changes alarm state. For instance, if a channel is within limits and then exceeds limits, or if a channel is exceeding limits and then falls within limits--a complete channel frame output will occur. The two basic operational modes described for the POA option also remain effective for the POCAS option.

c. If the optional Seiko printer output device is used, channels in alarm are printed in red. The total number of channels outputted in the alarm condition are indicated on the display[1] after each output cycle (see Figure 3-5), provided the instrument is engaged in the "Input Mode" of operation.

d. If the "System Constant Printout" ("Program Printout") option is used, the alarm setpoints program in RAM storage may be outputted on command (see paragraph 3.5.2). With or without the printout option, the alarm setpoints may be reviewed on the display by following appropriate steps in Table 2 on the right-hand foldout sheet of the operational flow diagram.

e. The POA and POCAS functions are programmed into the system via keyboard programming Section 1.2.1 on the operational flow diagram foldout. Once either function has been programmed, operation is begun by pressing the MAN REC key. Interruption of the POA or POCAS function for entry of subsequent keyboard instructions is accomplished by pressing the HALT key. If it is desired to re-engage the POA or POCAS function after a "halt" operation, press MAN REC key again. Also, see operation of HALT key under keyboard programming Section 1.1 on operational flow diagram foldout.

> NOTE: Operation or re-engagement of the POA and POCAS functions may also be initialized by the programmed "scan interval" time (if "next scan" time has not been inhibited) or by a remote scan trigger signal.

3.5.3.3 ALARM OUTPUT PACKAGES

Diverse alarm output functions are available as follows:

a. BASIC MODE: In this mode, the alarm channels are indicated in the output record whenever a channel data frame is outputted. If the optional Seiko printer output device is used, channels in alarm are printed in red. A period preceding the channel data signals a low-alarm condition; whereas, a colon preceding the channel data denotes a high-alarm condition (see Figure 3-4). The same data can be outputted to any peripheral device with appropriate punctuation to indicate the alarm channel values.

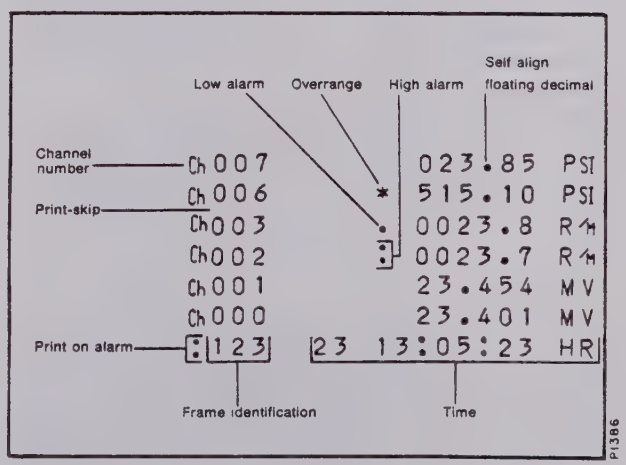


Figure 3-4. Typical Channel Frame Printout With "Alarm" Indication.

[1] "Alarm" totalizer feature is not available in all alarm programs (consult factory).

Table 3-1. Memory Allocations[1] for Alarm System Configurations.

CHANNEL PROGRAMMING SYSTEM	"CLASS A" ALARM SETPOINT CONFIGURATION[2] (Dual or Single Setpoints are Assignable Per Certain Fixed Channels in System; High-Low Common Setpoints Assigned to all Channels in System)				"CLASS B" ALARM SETPOINT CONFIGURATION[3] (Dual Setpoints are Assignable to any Channel in System)			
	MAXIMUM SIGNAL INPUT CHANNELS	MAXIMUM CHANNELS WITH ALARM SETPOINTS	ALARM OUTPUT FUNCTIONS[4] Basic Options	ALARM OUTPUT FUNCTIONS[4] Additional Options	MAXIMUM SIGNAL INPUT CHANNELS	NUMBER OF DUAL SETPOINTS	ALARM OUTPUT FUNCTIONS Basic	ALARM OUTPUT FUNCTIONS Optional
Single Channel	124	None	None	None	104	4, 8, 12, or 16 With any Assortment of High-Low, Higher-High, or Lower-Low Setpoints Assignable to any or all of the 104 Channels.	POA[5]	(1) Triple common-alarm relays only--one common high-alarm relay, one common low-alarm relay, and one common relay for either a high alarm or low alarm; (2) or one relay output per setpoint without the triple common-alarm relays; (3) or one relay output per setpoint including the triple common-alarm relays.
	116	One Common High-Low Alarm for all Channels in System	POA[5]	One Common-Alarm Relay for Either a High or Low Alarm				
	80	80 With One Setpoint (High or Low) per Channel	POA[5]	One Common-Alarm Relay for Either a High or Low Alarm				
	64	56 With Dual Setpoints (High-Low) per Channel	POA[5] or POCAS[6]	Individual Channel-Alarm Relays With or Without One Common-Alarm Relay				
Channel Pair	248	None	None	None	208	4, 8, 12, or 16 With any Assortment of High-Low, Higher-High, or Lower-Low Setpoints Assignable to any or all of the 208 Channels.		
	232	One Common High-Low Alarm for all Channels in System	POA[5]	One Common-Alarm Relay for Either a High or Low Alarm				
	120	120 With One Setpoint (High or Low) per Channel	POA[5]	One Common-Alarm Relay for Either a High or Low Alarm				
	96	64 With Dual Setpoints (High-Low) per Channel	POA[5] or POCAS[6]	Individual Channel-Alarm Relays With or Without One Common-Alarm Relay				

[1]Input channels and alarm setpoints are stored in total capacity of 31 RAMs and share the capacity at the exchange rate of:

Eight[7] analog or digital input channels, or four[8] analog or digital input channels = 8 single setpoints (high or low) = 4 dual setpoints (high-low, higher-high, or lower-low) = 1 RAM

[2]For RAM storage allocations, refer to instruction Form #PD-2064MSL in "Section G" of the Appendix.
[3]For RAM storage allocations, refer to instruction Form #PD-2064AAS in "Section G" of the Appendix.
[4]For "Class A" alarm relay output configurations, refer to instruction Form #PD-2064ARO in "Section B" of the Appendix.
[5]Print-on-alarm
[6]Print-only-on-change-of-alarm status
[7]Channel pair programming system
[8]Single channel programming system

(Intentionally blank)

b. OPTION #1: This option[1] includes the same functions of the basic mode above plus the provision for one common-alarm relay output.[2] For low-current load requirements, the output relay is a small SPST reed-type relay rated at 10 VA (0.5 A maximum) or 100 VDC (maximum) and is mounted internally. The output relay becomes energized for either a high alarm or low alarm on any channel upon completion of the data scan and output cycle. The relay remains energized until subsequent channel scans detect a "no-alarm" condition.

c. OPTION #2: This option[1] includes the same functions of the basic mode above plus individual channel-alarm relay outputs[2] with or without the common-alarm relay output described under option #1 above. The relays are mounted on PC cards which plug into the auxiliary card cage at the rear of the PD-2064 or into one of the card cages on an expander package. One SPST relay is provided for each alarm channel outputted. The individual alarm relay outputs are installed on consecutive channels and in groups of eight, starting with channel zero or a channel number divisible by eight (i.e., starting at 0, 8, 16, 24, etc.). Either a high or low alarm on a given channel energizes its own relay upon completion of the data scan and output cycle. The relays remain energized until subsequent channel scans no longer encounter an alarm condition. These relays are of the same type and rating as the common-alarm relay output used for low-current load requirements described under #1 above. The maximum number of alarm relays that can be employed in a system is 64.

NOTE: Combination of the "Memory Save" option (paragraph 3.5.4) and optional alarm relay outputs require special consideration. Consult factory.



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Figure 3-5. "Alarm" Option Feature Totalizes Number of Alarm Channels (2) on Display After Output Cycle.

3.5.3.4 "ALARM" OPTION PROGRAMMING

a. Programming procedures involving the "Alarm" option are given in keyboard programming Sections 1.2.1, 1.3.3, 3.4 and 3.5 on the operational flow diagram foldout.

NOTE: Programming of alarm setpoints[1] must be programmed consecutively, beginning with channel zero and ending with the last desired alarm channel.

b. It is possible to arm channels with the alarm function even though prescribed channels do not have memory storage locations for their setpoints. If this is done (i.e., channels are armed with the 2-character "Alarms" correction function code), these channels will have the alarm detection capability, but no alarm detection will take place because the alarm setpoints are missing.

3.5.4 "MEMORY SAVE" OPTION

a. The "Memory Save" option is a built-in, automatically-initiated power failsafe feature that supplies DC operating voltages to the microprocessor in the event of a power loss at the AC mains.

b. If a power outage occurs during normal operation, programmed information stored in the RAMs is lost. If the system is equipped with the optional custom initialization ROM, resumption of power automatically reprograms the RAMs; but in systems without the custom ROM, reprogramming of the RAMs becomes necessary through keyboard instructions. The memory save option saves the programs in RAM storage during short periods of power loss, so that when power resumes, channel scanning and data outputting continues on scan interval according to programs stored in the RAMs without necessity of reprogramming from keyboard.

---

[1]Options #1 and #2 and the method of programming the single and dual channel-alarm setpoints herein apply to the "Class A" alarm setpoint configuration as listed in Table 3-1. For method of programming the high-low, common-alarm setpoints for all channels in system, refer to paragraph G.2 in "Section G" of the Appendix. For description relating to the "Class B" alarm setpoint configuration (Table 3-1), refer to instruction Form #PD-2064AAS in "Section G" of the Appendix.

[2]For "Class A" alarm relay output configurations (Table 3-1), refer to instruction Form #PD-2064ARO in "Section B" of the Appendix.

c. The memory save DC power supply is derived from 3 batteries mounted internally on the PD-2064 chassis (see Figure 1-2). Operation of the microprocessor and the programs stored in the RAMs can be sustained from the DC supply for approximately 10 minutes during a power outage at the AC mains. If more than 10 minutes of power outage protection is desired, additional batteries or an uninterruptible DC power supply can be provided. The batteries are kept fully charged from the AC line during normal operation and are automatically switched into the memory save mode if a power transient or outage occurs.[3]

d. If a power outage occurs, system operation automatically reverts to the "Automatic Mode" and system control functions as follows: (1) DC power is interrupted to output interface(s); (2) display is blanked out; (3) clock continues operating and central processing unit continues to function so that programs stored in RAMs are retained; (4) keyboard is functionally disabled; and (5) channel scanning and data outputting operations are inhibited. When AC power is restored, system operation remains in the "Automatic Mode;" but system resumes its programmed operations of scanning, measuring, and outputting channel data while powering down between channel frame scans.

PRECAUTIONARY OPERATING NOTES:

(1) When instrument is equipped with the "Memory Save" option, power should not be interrupted from unit by removing power cord from AC outlet while instrument's power switch is still turned on. To do so will energize the "memory save" circuits and cause needless discharging of the batteries. Therefore, if it is desired to turn the instrument off or unplug the power cord, first shut off power with instrument's power switch.

(2) Restoration of AC power to the PD-2064 may not necessarily bring external output peripherals back on to line power. The AC power to the PD-2064 is independent from the AC power input to any output peripherals connected into the data system. Therefore, if an AC power loss is experienced, make sure that AC power to peripherals as well as the PD-2064 is back on line power for continued operation of the data system.

(3) The first data scan after a power outage may be erroneous due to the analog power supply start-up conditions. Subsequent scans, however, will be valid.

3.5.5 "CONTINUOUS PRINT" OR "RECORD" MODE

a. This inherent feature of the PD-2064 enables the system to continuously scan and output channel data at its maximum rate regardless of the programmed scan time interval.

b. This special mode of operation is programmed according to keyboard programming Section 1.2.2 on the operational flow diagram foldout; and it is initialized at the next scan time interval of the system. The continuous scan and output mode may be interrupted for entry of keyboard instructions by pressing the HALT key. See operation of HALT key under keyboard programming Section 1.1 on the operational flow diagram foldout.

3.5.6 GROUP (BLOCK) PROGRAMMING OF CHANNEL CONSTANTS AND ALARM SETPOINTS

a. The keyboard programming procedures for entering the channel constants program (Sections 3.1, 3.3, and 3.4 on operational flow diagram foldout) are given on a channel pair basis; whereas, the procedures for entering the alarm setpoints program (Sections 3.1 and 3.5 on foldout) are given on an individual channel basis.

b. In a lengthy program where the setting of a particular channel constant or setpoint is repeated for consecutive channels or channel pairs, programming can be greatly simplified and expedited by programming in groups or blocks of channels. This method of programming is inherently built into the system and is described in the following paragraphs 3.5.6.1 through 3.5.6.6.

3.5.6.1 SELECTING SAME CHANNEL CONSTANTS FOR GROUPS OF CHANNEL PAIRS[1]

a. Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which constants are to be programmed. (Example: channels 0 & 1)

b. Perform Step a in Section 3.3 of operational flow diagram. (Example: UNITS key pressed)

c. Select number of additional channel pairs (maximum of 9 additional pairs including initial channel pair) for which constant is to be programmed (Example: 5 total pairs). Enter number 4 with numeric key.[2]



d. Press any numeric key (Example: "1" key) 6 times so that 4 in display is entered in the 7th digit position.

Example:

[1]Maximum of 10 pairs per group. [2]If error is made when selecting numeric entry, press CLEAR ENTRY key. Then, reselect correct numeric entry. [3]In the event the PD-2064 is routinely shut down for a period of 3 months or more, the instrument should be turned on at least once every 3 months for a period of 12 hours so that the internal batteries are kept recharged and in a chargeable condition.

e. Select desired code[1] with numeric keys (Example: "0" code) so that code is entered in LSD of display and number of channel pairs (4) is entered in MSD of display.[2]

Example: 

f. Press ENTER to register program into memory. Display reads measured data (stored in memory from last channel frame scan) of selected channel number.[3]

Example: 

g. Repeat Steps b through f for each channel constant that is to be the same for the group of channel pairs selected.

h. To select same channel constants for a different group of channel pairs, repeat Steps a through g.

NOTE: Custom initialization or keyboard entry of either a single character or 2-character correction function code (except "0" or "0A" code) sets the proper correction function and, in addition, automatically programs the proper range code and units code for the specific correction function(s) entered. It should also be noted that keyboard entry of either a single or 2-character correction function code (except "0" or "0A") automatically alters the existing in-storage range code and units code to some other random codes even though there are no correction function ROMs employed in the system.

i. If "System Constant Printout" option is used, confirm program entry by performing Section 1.3.2 of operational flow diagram. Refer to Figure 3-6A for printout example.

j. As given by examples in preceding steps, printout should indicate a units code of "0" for channel pairs 0 (0 & 1), 2 (2 & 3), 4 (4 & 5), 6 (6 & 7), and 8 (8 & 9).

k. If "System Constant Printout" option is omitted, program entry may be confirmed by viewing display as follows:

(1) Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which channel constants were programmed. (Example: channels 0 & 1)

(2) Press appropriate channel constant key (Example: UNITS), and view display. Display should read selected code.

Example: 

(3) Thereafter, alternately press NEXT CHAN key and appropriate channel constant key (Example: UNITS) for selected channel pairs (Example: channels 0 through 9. Display should read programmed code for each channel selected.

Example: 

3.5.6.2 SELECTING SAME CHANNEL CONSTANTS FOR A BEGINNING CHANNEL PAIR AND ALL SUBSEQUENT CHANNEL PAIRS THEREAFTER

a. Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which constants are to be programmed. (Example: channels 0 & 1)

b. Perform Step a in Section 3.3 of operational flow diagram. (Example: I-0 key pressed)

c. Press MINUS key 7 times so that display reads  .

d. Select desired code[1] with numeric keys (Example: "1" code) so that code is entered in LSD of display and minus sign (-) is entered in MSD of display.[2]

Example: 

MSD POSITION

LSD POSITION

e. Perform Step f in paragraph 3.5.6.1.

f. Repeat Steps b through e for each channel constant that is to be the same for the block of channel pairs selected.

NOTE: Custom initialization or keyboard entry of either a single character or 2-character correction function code (except "0" or "0A" code) sets the proper correction function and, in addition, automatically programs the proper range code and units code for the specific correction function(s) entered. It should also be noted that keyboard entry of either a single or 2-character correction function code (except "0" or "0A") automatically alters the existing in-storage range code and units code to some other random codes even though there are no correction function ROMs employed in the system.

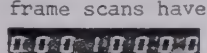
g. Perform appropriate steps in Section 3.1 of operational flow diagram, and select channel pair at which the channel frame scan length is to be ended.

Example: 

---

[1] See channel constant codes on instrument DATA SHEET.

[2] If error is made when selecting numeric entry, press CLEAR ENTRY key. Then, reselect correct numeric entry.

[3] If no channel frame scans have been made since instrument "turn on," display reads all zeros (0's) or  . (Decimal point location dependent on range code).

"STOP" INPUT CODE PROGRAMMED FOR CHANNEL PAIR 20 & 21. CHANNEL PAIR HAVING "STOP" INPUT CODE IS NOT PRINTED.

```
Ch018        1 0 .3 1   V
Ch016        1 0 .3 1   V
Ch014        1 0 .3 1   V
Ch012        1 0 .3 1   V
Ch010        1 0 .3 1   V
Ch008        1 0:.3 0  MV
Ch006        1 0:.3 0  MV
Ch004        1 0:.3 0  MV
Ch002        1 0:.3 0  MV
Ch000        1 0:.3 0  MV
Ch***          00.00   MV
2064   00  10:52:15   HR
```

CHANNEL CONSTANTS

A

```
Ch018        1 0:.3 1   V
Ch016        1 0:.3 1   V
Ch014        1 0:.3 1   V
Ch012        1 0:.3 1   V
Ch010        1 0:.3 1   V
Ch008        1 0 .3 0  MV
Ch006        1 0 .3 0  MV
Ch004        1 0 .3 0  MV
Ch002        1 0 .3 0  MV
Ch000        1 0 .3 0  MV
Ch***          00.00   MV
2064   00  11:10:02   HR
```

CHANNEL CONSTANTS

B

```
Ch019      : 35.684     V
Ch019      . 12.345     V
Ch018      : 35.684     V
Ch018      . 12.345     V
Ch017      : 35.684     V
Ch017      . 12.345     V
Ch016      : 35.684     V
Ch016      . 12.345     V
Ch015      : 35.684     V
Ch015      . 12.345     V
Ch014      : 35.684     V
Ch014      . 12.345     V
Ch013      : 35.684     V
Ch013      . 12.345     V
Ch012      : 35.684     V
Ch012      . 12.345     V
Ch011      : 35.684     V
Ch011      . 12.345     V
Ch010      : 35.684     V
Ch010      . 12.345     V
Ch009      : 37.418    MV
Ch009      .-25.437    MV
Ch008      : 37.418    MV
Ch008      .-25.437    MV
Ch007      : 37.418    MV
Ch007      .-25.437    MV
Ch006      : 37.418    MV
Ch006      .-25.437    MV
Ch005      : 37.418    MV
Ch005      .-25.437    MV
Ch004      : 37.418    MV
Ch004      .-25.437    MV
Ch003      : 37.418    MV
Ch003      .-25.437    MV
Ch002      : 37.418    MV
Ch002      .-25.437    MV
Ch001      : 37.418    MV
Ch001      .-25.437    MV
Ch000      : 37.418    MV
Ch000      .-25.437    MV
Ch***        00.00     V
2064   00  12:21:42   HR
```

ALARM SETPOINTS

C

```
Ch019      : 37.418     V
Ch019      .-25.437     V
Ch018      : 37.418     V
Ch018      .-25.437     V
Ch017      : 37.418     V
Ch017      .-25.437     V
Ch016      : 37.418     V
Ch016      .-25.437     V
Ch015      : 37.418     V
Ch015      .-25.437     V
Ch014      : 37.418     V
Ch014      .-25.437     V
Ch013      : 37.418     V
Ch013      .-25.437     V
Ch012      : 37.418     V
Ch012      .-25.437     V
Ch011      : 37.418     V
Ch011      .-25.437     V
Ch010      : 37.418     V
Ch010      .-25.437     V
Ch009      : 37.418    MV
Ch009      .-25.437    MV
Ch008      : 37.418    MV
Ch008      .-25.437    MV
Ch007      : 37.418    MV
Ch007      .-25.437    MV
Ch006      : 37.418    MV
Ch006      .-25.437    MV
Ch005      : 37.418    MV
Ch005      .-25.437    MV
Ch004      : 37.418    MV
Ch004      .-25.437    MV
Ch003      : 37.418    MV
Ch003      .-25.437    MV
Ch002      : 37.418    MV
Ch002      .-25.437    MV
Ch001      : 37.418    MV
Ch001      .-25.437    MV
Ch000      : 37.418    MV
Ch000      .-25.437    MV
Ch***        00.00     MV
2064   00  12:30:12   HR
```

ALARM SETPOINTS

D

PRINTOUT LEGEND

REFER TO "PRINTOUT LEGEND" GIVEN FOR "SEIKO" PRINTOUT EXAMPLES ON RIGHT-HAND, FOLDOUT SHEET OF OPERATIONAL FLOW DIAGRAM.

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Figure 3-6. "Seiko" Printout Examples of Group (Block) Programming of Channel Constants and Alarm Setpoints.

h. Press I-O key and enter "stop" input code "9" for channel pair 20 (20 & 21) by following procedures in Section 3.3 of operational flow diagram.

Example: 

i. If "System Constant Printout" option is used, confirm program entry by performing Section 1.3.2 of operational flow diagram. Refer to Figure 3-6A for printout example.

j. As given by examples in preceding steps, printout should indicate an input/output code of "1" for beginning channel pair 0 (0 & 1) and all subsequent channel pairs throughout the remainder of the channel frame scan length.

k. If "System Constant Printout" option is omitted, program entry may be confirmed by viewing display as follows:

(1) Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which channel constants were programmed. (Example: channels 0 & 1)

(2) Press appropriate channel constant key (Example: I-0) and view display. Display should read programmed code.

Example: 

(3) Alternately press NEXT CHAN key and appropriate channel constant key (Example: I-0) for selected channel pairs (beginning channel pair of 0 & 1 and all subsequent channel pairs thereafter). Display should read programmed code for each channel selected.

Example: 

3.5.6.3 SELECTING SAME SPECIAL CORRECTION FUNCTION CODES (2-PART CODE) FOR GROUPS OF CHANNEL PAIRS[1]

NOTE: Programming operations which follow are exemplary for the "Alarms" option on input channels having a zero ("0") correction function code for the first part of the two-part code. Other special two-part correction function codes are programmed in same manner. See Data Sheet for special correction function codes.

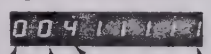
a. Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which correction function codes are to be programmed. (Example: channels 0 & 1)

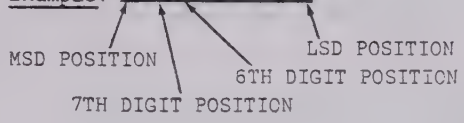
b. Press CORR FUNCT key. Display reads prevailing correction function code.

Example: 

c. Perform Step c in paragraph 3.5.6.1.

d. Press any numeric key (Example: "1" key) 5 times so that 4 in display is entered in the 6th digit position.

Example: 



e. Select number "0" code with numeric key so that 4 is entered in 7th digit position and "0" code is entered in LSD of display.[2]

Example: 

f. Press HIGH ALARM or LOW ALARM key to enter letter "A" code in LSD of display and number of channel pairs (4) in MSD of display.

Example: 

g. Perform Step f in paragraph 3.5.6.1.

h. To select "Alarms" option correction function code (0A) or other special 2-part correction function code for a different group of channel pairs, repeat Steps a through g.

NOTE: Custom initialization or keyboard entry of either a single character or 2-character correction function code (except "0" or "0A" code) sets the proper correction function and, in addition, automatically programs the proper range code and units code for the specific correction function(s) entered. It should also be noted that keyboard entry of either a single or 2-character correction function code (except "0" or "0A") automatically alters the existing in-storage range code and units code to some other random codes even though there are no correction function ROMs employed in the system.

i. If "System Constant Printout" option is used, confirm program entry by performing Section 1.3.2 of operational flow diagram. Refer to Figure 3-6A for printout example.

---

[1] Maximum of 10 pairs per group.

[2] If error is made when selecting numeric entry, press CLEAR ENTRY key. Then, reselect correct numeric entry.

j. As given by examples in preceding steps, printout should indicate a correction function code of "0:" for channel pairs 0 (0 & 1), 2 (2 & 3), 4 (4 & 5), 6 (6 & 7), and 8 (8 & 9).

NOTE: The colon (:) in correction function code "0:" printout denotes the letter "A" (for "Alarms").

k. If "System Constant Printout" option is omitted, program entry may be confirmed by viewing display as follows:

(1) Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which correction function codes were programmed. (Example: channels 0 & 1)

(2) Press CORR FUNCT key and view display. Display should read programmed code.

Example: 

(3) Thereafter, alternately press NEXT CHAN key and CORR FUNCT key for selected channel pairs (Example: channels 0 through 9). Display should read programmed code for each channel selected.

Example: 

3.5.6.4 SELECTING SAME SPECIAL CORRECTION FUNCTION CODE (2-PART CODE) FOR A BEGINNING CHANNEL PAIR AND ALL SUBSEQUENT CHANNEL PAIRS THEREAFTER

NOTE: Programming operations which follow are exemplary for the "Alarms" option on input channels having a zero ("0") correction function code for the first part of the two-part code. Other special two-part correction function codes are programmed in same manner. See Data Sheet for special correction function codes.

a. Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which correction function codes are to be programmed. (Example: channels 10 & 11)

b. Press CORR FUNCT key. Display reads prevailing correction function code.

Example: 

c. Press MINUS key 6 times so that display reads



d. Select number "0" code with numeric key so that minus sign (-) is entered in 7th digit position and "0" code is entered in LSD position of display.[1]

Example: 

e. Press HIGH ALARM or LOW ALARM key to enter letter "A" code in LSD position and minus sign (-) in MSD position of display.

Example: 

f. Perform Step f in paragraph 3.5.6.1.

g. To select "Alarms" option correction function code (0A) or other special 2-part correction function code for a different block of channel pairs, repeat Steps a through f.

NOTE: Custom initialization or keyboard entry of either a single character or 2-character correction function code (except "0" or "0A" code) sets the proper correction function and, in addition, automatically programs the proper range code and units code for the specific correction function(s) entered. It should also be noted that keyboard entry of either a single or 2-character correction function code (except "0" or "0A") automatically alters the existing in-storage range code and units code to some other random codes even though there are no correction function ROMs employed in the system.

h. If "System Constant Printout" option is used, confirm program entry by performing Section 1.3.2 of operational flow diagram. Refer to Figure 3-6B for printout example.

i. As given by examples in preceding steps, printout should indicate a correction function code of "0:" for beginning channel pair 10 (10 & 11) and all subsequent channel pairs throughout the remainder of the channel frame scan length.

NOTE: The colon (:) in correction function code "0:" printout denotes the letter "A" (for "Alarms").

j. If "System Constant Printout" option is omitted, program entry may be confirmed by viewing display as follows:

(1) Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning channel pair for which correction function codes were programmed. (Example: channels 10 & 11)

[1] If error is made when selecting numeric entry, press CLEAR ENTRY key. Then, reselect correct numeric entry.

(2) Press CORR FUNCT key and view display. Display should read programmed code.

Example: 

(3) Alternately press NEXT CHAN key and CORR FUNCT key for selected channel pairs (beginning channel pair of 10 & 11 and all subsequent channel pairs thereafter). Display should read programmed code for each channel selected.

Example: 

3.5.6.5 SELECTING SAME ALARM SETPOINTS FOR GROUPS OF INDIVIDUAL CHANNELS[1, 2]

a. Perform appropriate steps in Section 3.1 of operational flow diagram, and select beginning single channel for which high and/or low alarm setpoints are to be programmed. (Example: channel 0).

b. Press LOW ALARM key. Display reads prevailing low alarm setpoint (5 digits).[3]

Example: 

LOW ALARM INDICATION (NOT DECIMAL POINT)

DECIMAL POINT (LOCATION DEPENDENT ON RANGE CODE)

c. Select number of additional individual channels (maximum of 9 additional channels including initial channel) for which same alarm setpoint is to be programmed (Example: 10 total channels). Enter number 9 with numeric key. Display reads

 .

d. If negative setpoint is desired, press any one of the numeric keys (Example: "0" key) once for a digit filler; press MINUS key, and then select desired setpoint (5 digits) with numeric keys. If positive setpoint is desired, press any numeric key (Example: "0" key) twice for digit fillers; then select desired setpoint with numeric keys. Display reads keyed entry.

Examples:

LOW ALARM



NEGATIVE SETPOINT

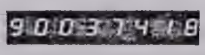


POSITIVE SETPOINT

HIGH ALARM



NEGATIVE SETPOINT



POSITIVE SETPOINT

e. Perform Step f in paragraph 3.5.6.1.

f. Press HIGH ALARM key. Display reads prevailing high alarm setpoint (5 digits).[4]

Example: 

HIGH ALARM INDICATION

DECIMAL POINT (LOCATION DEPENDENT ON RANGE CODE)

g. Repeat Steps c, d, and e.

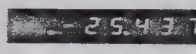
h. To select alarm setpoints for a different group of individual channels, repeat Steps a through g.

i. If "System Constant Printout" option is used, confirm program entry by performing Section 1.3.3 of operational flow diagram. Refer to Figure 3-6C for printout example. As given by examples in preceding steps, printout should indicate low and high alarm setpoints programmed for channels 0 through 9.

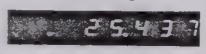
j. If "System Constant Printout" option is omitted, program entry may be confirmed by viewing display as follows:

(1) Perform appropriate steps in Section 3.1 of operational flow diagram to select beginning channel for which alarm setpoints were programmed (Example: channel 0).

(2) Press LOW ALARM key and view display. Display should read selected low alarm setpoint.

Examples: 

NEGATIVE SETPOINT



POSITIVE SETPOINT

(3) Alternately press NEXT CHAN key and LOW ALARM key for selected channels (Example: channels 0 through 9). Display should read selected low alarm setpoint for each channel selected. See examples in Step 2.

(4) Repeat Step 1 above.

(5) Press HIGH ALARM key and view display. Display should read selected high alarm setpoint.

Examples: 

NEGATIVE SETPOINT



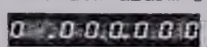
POSITIVE SETPOINT

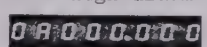
(6) Alternately press NEXT CHAN key and HIGH ALARM key for selected channels (Example: channels 0 through 9). Display should read selected high alarm setpoint for each channel selected. See examples in Step 5.

---

[1] Maximum of 10 channels per group.

[2] These programming operations become functional only if "Alarm" option is used.

[3] If no previous low alarm setpoint has been entered in memory, exemplary display reads  .

[4] If no previous high alarm setpoint has been entered in memory, exemplary display reads  .

3.5.6.6 SELECTING SAME ALARM SETPOINTS FOR A BEGINNING CHANNEL AND ALL SUBSEQUENT INDIVIDUAL CHANNELS THEREAFTER[1]

a. Perform Steps a and b in paragraph 3.5.6.5.

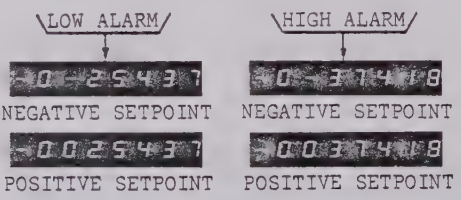
b. Press MINUS key so that display reads



.

c. If negative setpoint is desired, press any one of the numeric keys (Example: "0" key) once for a digit filler; press MINUS key, and then select desired setpoint (5 digits) with numeric keys. If positive setpoint is desired, press any numeric key (Example: "0" key) twice for digit fillers; then select desired setpoint with numeric keys. Display reads keyed entry.

Examples:



d. Perform Step f in paragraph 3.5.6.1.

e. Perform Step f in paragraph 3.5.6.5.

f. Repeat Steps b, c, and d above.

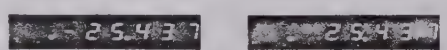
g. If "System Constant Printout" option is used, confirm program entry by performing Section 1.3.3 of operational flow diagram. Refer to Figure 3-6D for printout example. As given by examples in preceding steps, printout should indicate low and high alarm setpoints for beginning channel 0 and all subsequent individual channels throughout the remainder of the channel frame scan length.

h. If "System Constant Printout" option is omitted, program entry may be confirmed by viewing display as follows:

(1) Perform appropriate steps in Section 3.1 of operational flow diagram to select beginning channel for which alarm setpoints were programmed (Example: channel 0).

(2) Press LOW ALARM key and view display. Display should read selected low alarm setpoint.

Examples:



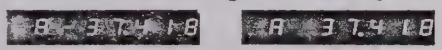
NEGATIVE SETPOINT POSITIVE SETPOINT

(3) Alternately press NEXT CHAN key and LOW ALARM key for selected channels (Example: beginning channel 0 and all subsequent individual channels thereafter). Display should read selected low alarm setpoint for each channel selected. See examples in Step 2.

(4) Repeat Step 1 above.

(5) Press HIGH ALARM key and view display. Display should read selected high alarm setpoint.

Examples:



NEGATIVE SETPOINT POSITIVE SETPOINT

(6) Alternately press NEXT CHAN key and HIGH ALARM key for selected channels (Example: beginning with channel 0 and all subsequent individual channels thereafter). Display should read selected high alarm setpoint for each channel selected. See examples in Step 5.

3.5.7 "SCAN AND OUTPUT" OR "OUTPUT ONLY" MODE

a. This built-in feature of the PD-2064 provides versatile control over the channel frame selectivity by which channel data may be both scanned and outputted, or outputted only.

b. The principles involved in this mode of operation for a typical channel frame scan length is exemplified in essence by the tabulation in Table 3-2.

3.5.8 PROGRAMMING EXAMPLE

The following programming example is given as a test problem to determine how well the operator understands and performs the basic keyboard programming functions. Before implementing the programming operations cited in this example, take time to carefully read and study all previous information contained in this section ("Operation") of the manual.

3.5.8.1 PROGRAM INSTRUCTIONS

Read "Program Specifications" under paragraph 3.5.8.2, and fill in the appropriate places on programming worksheets #1 and #2. Examples of filled-out worksheets for the given program specifications are shown in Figures 3-7 and 3-8. Blank worksheet forms are found near the end of this section. Obtain channel constant codes from instrument Data Sheet or from Table 1 on the operational flow diagram foldout. The Seiko printer is used as the optional output device(s) in this programming example.

[1] These programming operations become functional only if "Alarm" option is used.

Table 3-2. I-O Code Input/Output Functions.

CHANNEL NOS.	TYPE INPUT	I-O CODE *	INPUT/OUTPUT FUNCTION	OPERATIONAL SEQUENCE OF A TYPICAL CHANNEL FRAME LENGTH
0 ↕ 9	Analog	Any one of codes 0 through 3 may be programmed.	Channel inputs scanned and measured data outputted	(1) Analog input channels 0 through 9 are scanned and outputted according to programmed instructions in memory. Analog data is outputted to device(s), as instructed by the programmed I-O code.
10 ↕ 15	Digital	Any one of codes 4 through 7 may be programmed.	Channel inputs scanned and measured data outputted	(2) Digital input channels 10 through 15 are scanned and outputted according to programmed instructions in memory. Digital data is outputted to device(s), as instructed by the programmed I-O code.
16 ↕ 17	Irrelevant	Code 8 programmed	Input scan stopped	(3) Input scanning of the channels is stopped at channel pair 16 (16 and 17), as instructed by programmed I-O code 8. Channel pair 16 is skipped from the output record. Outputting resumes at channel pair 18.
18 ↕ 29	Irrelevant	Any one of codes 0 through 7 may be programmed.	Channel data outputted only	(4) Data that is stored in memory for channels 18 through 29 is outputted to device (or skipped), as instructed by the programmed I-O code. Data stored in memory may have been entered from a previous channel frame scan, from an entry of CHAN READ data, or from channel data entered with the numeric keys. For entry of CHAN READ data or channel data entered with the numeric keys, refer to keyboard programming Section 3.2 on operational flow diagram foldout.
30 ↕ 31	Irrelevant	Code 9 programmed	Stops data outputting (end of channel frame length)	(5) Outputting of channels is stopped at channel pair 30 (30 and 31), as instructed by programmed I-O code 9. Channel pair 30 is not outputted. Outputting of channel frame length ends.

* See instrument Data Sheet or Table 1 on the operational flow diagram foldout for programmable I-O codes.

3.5.8.2 PROGRAM SPECIFICATIONS

a. SYSTEM CONSTANTS: Set following system constants (perform Step 6 last).

		Day	Hr	Min	Sec
(1)	TIME:	01	12	00	00

(2) REF CHAN: 00

(3) ID: 0212

(4) CHAN INTVL: 01 sec.

		Day	Hr	Min	Sec
(5)	SCAN INTVL:	00	00	00	45

		Day	Hr	Min	Sec
(6)	NEXT SCAN:	01	12	50	00

b. CHANNEL NUMBERS, CHANNEL CONSTANTS, AND ALARM SETPOINTS: Select channel numbers, and set following channel constants and alarm setpoints for channels selected.

> NOTE: Setting of alarm setpoints is applicable only if "Alarm" option is used.

(1) Select analog input channel pair 0 (0 and 1); output to device #1; set correction function code of "0" with "Alarms", 4000 mV range, and mV measurement units.

(2) Select analog input channel pair 2 (2 and 3); output to device #1; set correction function code of "0" with "Alarms", 4000 mV range, and ^{o}F measurement units.

(3) Select analog input channel pair 4 (4 and 5); output to devices #1 and #2; set correction function code of "0", 400 mV range, and ^{o}C measurement units.

(4) Select analog input channel pair 6 (6 and 7); output to devices #1 and #2; set correction function code of "0", 4000 mV range, and mV measurement units.

(5) Select analog input channel pair 8 (8 and 9); skip output for channel pair 8.

(6) Select analog input channel pair 10 (10 and 11); output to device #1; set correction function code of "0", 40 mV range, and PSI measurement units.

(7) Select digital input channel pair 12 (12 and 13); output to device #1; set correction function code of "0" with "Alarms", 400 mV range, and R/M measurement units.

(8) Select digital input channel pair 14 (14 and 15); output to devices #1 and #2; set correction function code of "0", 40 mV range, and V measurement units.

(9) Select channel pair 16 (16 and 17); stop input channel scanning at channel pair 16.

(10) Select beginning channel number 0, and set HIGH ALARM setpoint of 37418 for channel 0 and all subsequent channels in the channel frame selected (channels 0 through 17).

(11) Set LOW ALARM setpoint of -25437 for first seven channels (0 through 6).

(12) Set LOW ALARM setpoint of 12345 for remaining eleven channels (7 through 17) in channel frame length.

3.5.8.3 PROGRAMMING PROCEDURES

a. Refer to operational flow diagram foldout.

b. Start the programming with instrument power turned off.

c. Follow flow route numbers 1 through 4, and then to 6. Press the designated keys on keyboard as you progress along the flow route.

d. For programming the specifications given in Steps a1 through a6 above, use applicable program data entered on worksheet #1 and follow keyboard programming Section 2 on flow diagram.

e. For programming the specifications given in Steps b1 through b9 above, use applicable program data entered on worksheet #1, progress from flow route #6 to #'s 20, 22, and 23; and then follow appropriate keyboard programming Sections 3.1, 3.3, and 3.4 on flow diagram.

f. For programming the specifications given in Steps b10 and b12 above, use applicable program data entered on worksheet #2, progress from flow route #20 to #24; and then follow appropriate exemplary steps under paragraph 3.5.6.6.[1] For programming the specifications given in Step b11 above, use applicable program data entered on worksheet #2, and follow appropriate exemplary steps under paragraph 3.5.6.5.[1]

---

[1]This paragraph not part of flow diagram. Refer elsewhere in this section ("Operation") of the manual.

FORM NO 50509

PROGRAMMING WORKSHEET NO. 1

SYSTEM CONSTANTS AND CHANNEL CONSTANTS SPECIFICATION

ESTERLINE ANGUS
A UNIT OF ESTERLINE CORPORATION

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
063				
060				
058				
056				
054				
052				
050				
048				
046				
044				
042				
040				
038				
036				
034				
032				
030				
028				
026				
024				
022				
020				
018				
016	9	**	**	**
014	D	7	0	3	1
012	D	5	0	A	2	5
010	A	1	0	3	4
008	A	0	**	**	**
006	A	3	0	1	0
004	A	3	0	2	3
002	A	1	0	A	1	2
000	A	1	0	A	1	0

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
125				
124				
122				
120				
118				
116				
114				
112				
110				
108				
106				
104				
102				
100				
098				
096				
094				
092				
090				
088				
086				
084				
082				
080				
078				
076				
074				
072				
070				
068				
066				
064				

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
190				
188				
186				
184				
182				
180				
178				
176				
174				
172				
170				
168				
166				
164				
162				
160				
158				
156				
154				
152				
150				
148				
146				
144				
142				
140				
138				
136				
134				
132				
130				
128				

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
246				
244				
242				
240				
238				
236				
234				
232				
230				
228				
226				
224				
222				
220				
218				
216				
214				
212				
210				
208				
206				
204				
202				
200				
198				
196				
194				
192				

* DESIGNATE "A" (ANALOG) or "D" (DIGITAL) FOR EACH CHANNEL PAIR.

** UNNECESSARY TO SET REST OF PROGRAM SINCE I-O CODE INSTRUCTS MEASUREMENT SCAN AND OUTPUT OF CHANNEL PAIR 8 TO BE "SKIPPED", AND CHANNEL PAIR 16 TO BE "STOPPED."

SYSTEM CONSTANTS																					
REF CHAN	ID	CHAN INTVL	TIME				SCAN INTVL				NEXT SCAN										
			D	H	M	S	D	H	M	S	D	H	M	S							
0 0	0 2 1 2	0 1	0 1	1 2	0 0	0 0	0 0	0 0	0 0	1 4	5 0	1 1	2 5	0 0							

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Figure 3-7. Filled-Out Worksheet #1 of Program Example Specifications.

FORM NO 50510

PROGRAMMING WORKSHEET NO. 2

ALARM SETPOINT SPECIFICATION

ESTERLINE ANGUS
A UNIT OF ESTERLINE CORPORATION

TYPE	HI ALARM SETPOINT
0	3 7 4 1 8
1	
2	
3	
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	

TYPE	LO ALARM SETPOINT
0	- 2 5 4 3 7
1	1 2 3 4 5
2	
3	
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	

CHAN NO.	TYPE HI	LO
031		
030		
029		
028		
027		
026		
025		
024		
023		
022		
021		
020		
019		
018		
017	0	1
016	0	1
015	0	1
014	0	1
013	0	1
012	0	1
011	0	1
010	0	1
009	0	1
008	0	1
007	0	1
006	0	0
005	0	0
004	0	0
003	0	0
002	0	0
001	0	0
000	0	0

CHAN NO.	TYPE HI	LO
063		
062		
061		
060		
059		
058		
057		
056		
055		
054		
053		
052		
051		
050		
049		
048		
047		
046		
045		
044		
043		
042		
041		
040		
039		
038		
037		
036		
035		
034		
033		
032		

CHAN NO.	TYPE HI	LO
095		
094		
093		
092		
091		
090		
089		
088		
087		
086		
085		
084		
083		
082		
081		
080		
079		
078		
077		
076		
075		
074		
073		
072		
071		
070		
069		
068		
067		
066		
065		
064		

CHAN NO.	TYPE HI	LO
127		
126		
125		
124		
123		
122		
121		
120		
119		
118		
117		
116		
115		
114		
113		
112		
111		
110		
109		
108		
107		
106		
105		
104		
103		
102		
101		
100		
099		
098		
097		
096		

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Figure 3-8. Filled-Out Worksheet #2 of Program Example Specifications.

g[1]. Progress from flow route #6 to #14. Obtain a system constants and channel constants program printout by following keyboard programming Section 1.3.2 on flow diagram. See printout example in Figure 3-9A.

h[1]. Progress from flow route #6 to #15. Obtain an alarm setpoints program printout by following keyboard programming Section 1.3.3 on flow diagram. See printout example in Figure 3-9B.

i. Progress from flow route #6 to #13. Obtain a channel scan and output of the channel inputs by following keyboard programming Section 1.3.1 on flow diagram. Printout example is given in Figure 3-9C.

j. Press TIME key and check time on display. Follow appropriate procedures under keyboard programming Section 2 on flow diagram, and set NEXT SCAN time to the time indicated, plus 20 seconds. Progress from flow route #6 to #9; and then press AUTO key to enable automatic scanning and outputting of the channel inputs according to the program entered in memory as was specified under paragraph 3.5.8.2.

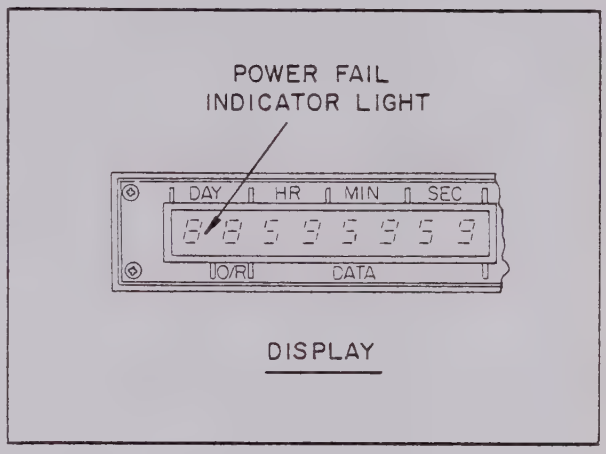
k. Obtain 3 channel frame printouts with instrument engaged in the "Automatic Mode". See printout examples in Figure 3-9D. After third printout is obtained, turn instrument off with power switch.

l. End of programming example.

NOTE: Turning instrument power off erases programs that have been entered in memory via the keyboard. When power is reapplied to the instrument, system automatically reverts to an initialized programmed state as is given in Table 2 on the right-hand, fold-out sheet of the operational flow diagram. The program constants indicated in Table 2 are the ones initialized when the "Custom Program Initialization" option (see paragraph 3.5.1) is not used. However, if the "Custom Program Initialization" option is used, the system's initialized programmed state should conform with the system requirements as specified on the instrument Data Sheet.

3.5.9 POWER FAIL INDICATOR LIGHT [2]

a. The power fail indicator light is located between the DAY digits on the display as shown below.



DISPLAY

b. Operational aspects of the power fail light are as follows:

(1) If system is equipped with the "Memory Save" option and the power fail light comes on during normal operation of the system (with instrument's power switch turned on), it serves to alert the operator that a power loss has occurred at the AC mains and remedial action should be taken. After power has been restored at the AC mains, light will remain on until "Input" mode is engaged. For description of "Memory Save" option, refer to paragraph 1.2.10 in Section 1 and paragraph 3.5.4 in Section 3 of manual.

(2) After instrument has been turned off (with instrument's power switch) and then turned back on, the power fail light will come on as an indication that power has been turned off and has hence been returned. The light will remain on until "Input" mode is engaged.

[1] This step is possible only if system incorporates "System Constant Printout" ("Program Printout") option. If this option is not included in system, program may be checked on display by following procedures given in Table 2 on the right-hand, fold-out sheet of the operational flow diagram.

[2] Used only in instruments that have the letter "A" suffixed to the serial number.

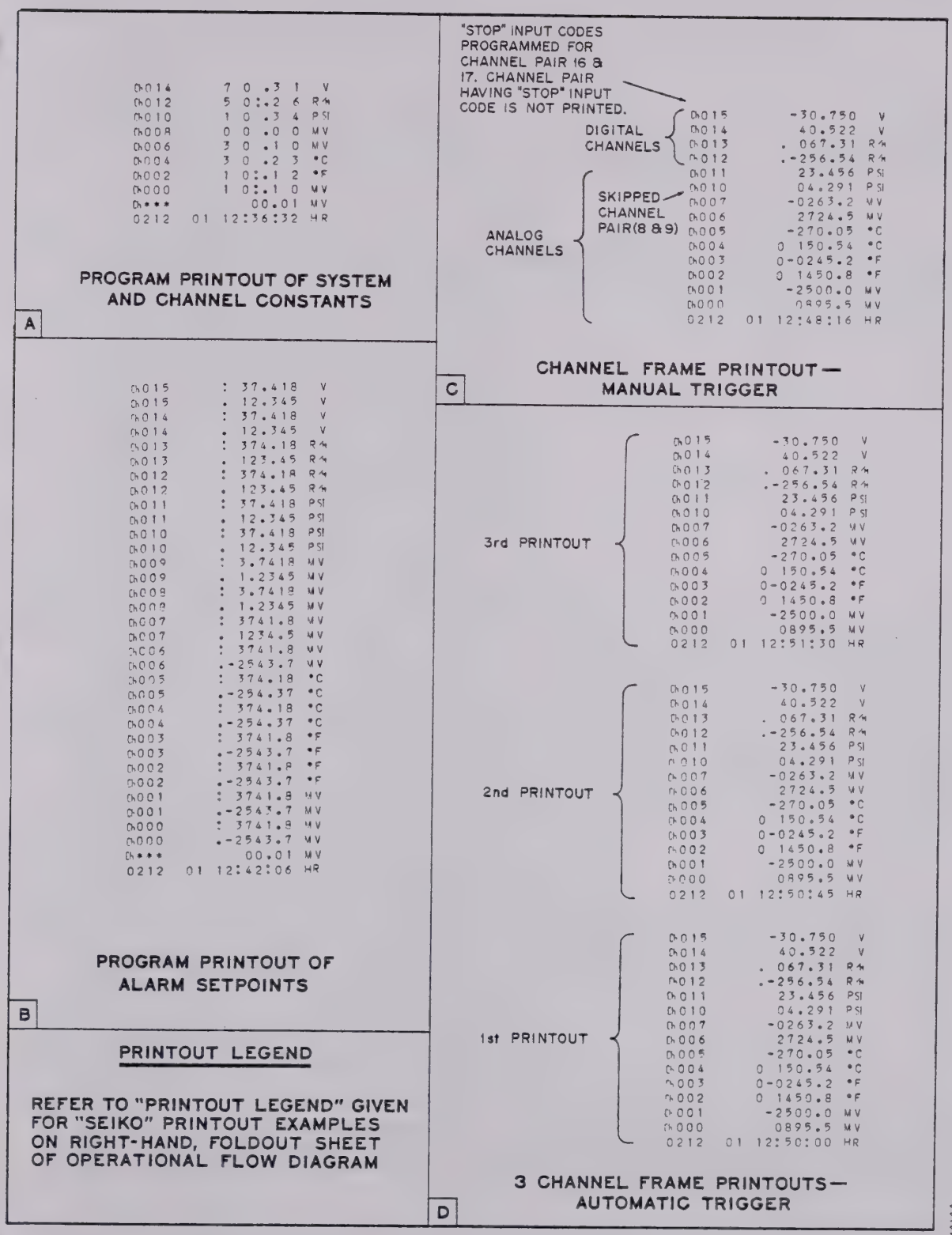


Figure 3-9. "Seiko" Printout Examples—Programming Test Problem.

OPERATIONAL NOTE:
From the two operational aspects given under paragraph 3.5.9b, it can be seen that it is not readily apparent from a casual observation of the "on" indication of the power fail light what condition(s) caused the light to come on. The conditional checks are given as follows:

CONDITIONS	CONDITIONAL CHECKS
A power loss presently exists at the AC mains. Instrument's power switch is turned on. System is equipped with "Memory Save" option.	Power key light is off. System is in "Auto" mode; but channel scanning, measuring, and outputting operations are inoperative. Keyboard is inoperative. When AC power is restored at mains (outtage should not last longer than 10 minutes for an effective functioning of "Memory Save"), power key light comes back on. Power fail light goes off when "Input" mode is engaged. A check of the RAM memory indicates that keyboard-entered programs have been saved. (NOTE: If power outtage lasted longer than 10 minutes, RAM memory would be lost. However, if "Custom Program Initialization" option was included in system, the restoration of AC power would automatically reprogram the RAM memory according to the custom program ROM or ROMs).
A temporary power loss (less than 10 minutes) occurred at the AC mains, but power was self-restored. Instrument's power switch is turned on. System is equipped with the "Memory Save" option.	Power key light is on. System is in "Auto" mode. Power fail light goes off when "Input" mode is engaged. A check of the RAM memory indicates that keyboard-entered programs or custom-initialized programs have been saved.[1]
A temporary power loss occurred at the AC mains, but power was self-restored. Instrument's power switch is turned on. System does not include the "Memory Save" option.	Power key light is on. System is in "Auto" mode. Power fail light goes off when "Input" mode is engaged. A check of the RAM memory indicates that keyboard-entered programs have been lost. (NOTE: If "Custom Program Initialization" option is included in the system, the self-restoration of AC power automatically reprogrammed the RAM memory according to the custom program ROM or ROMs).
Power had been turned off with the instrument's power switch, but has hence been turned back on.	Power key light is on. System is in "Auto" mode. Power fail light goes off when "Input" mode is engaged. A check of the RAM memory indicates that keyboard-entered programs have been lost. (NOTE: If "Custom Program Initialization" option is included in the system, the "turn-on" of power automatically reprograms the RAM memory according to the custom program ROM or ROMs).

[1]If temporary power loss lasted longer than 10 minutes, programs would have been lost. However, if "Custom Program Initialization" option was included in system, the self-restoration of AC power would have automatically reprogrammed the RAM memory according to the custom program ROM or ROMs.

Form No. 503PL

ESTERLINE ANGUS
A UNIT OF ESTERLINE CORPORATION

PROGRAMMING WORKSHEET NO. 1

SYSTEM CONSTANTS AND CHANNEL CONSTANTS SPECIFICATION

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
062				
060				
058				
056				
054				
052				
050				
048				
046				
044				
042				
040				
038				
036				
034				
032				
030				
028				
026				
024				
022				
020				
018				
016				
014				
012				
010				
008				
006				
004				
002				
000				

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
126				
124				
122				
120				
118				
116				
114				
112				
110				
108				
106				
104				
102				
100				
098				
096				
094				
092				
090				
088				
086				
084				
082				
080				
078				
076				
074				
072				
070				
068				
066				
064				

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
190				
188				
186				
184				
182				
180				
178				
176				
174				
172				
170				
168				
166				
164				
162				
160				
158				
156				
154				
152				
150				
148				
146				
144				
142				
140				
138				
136				
134				
132				
130				
128				

CHAN NO. *	CHANNEL CONSTANT CODES I-O	CORR FUNCT	RANGE	UNITS
246				
244				
242				
240				
238				
236				
234				
232				
230				
228				
226				
224				
222				
220				
218				
216				
214				
212				
210				
208				
206				
204				
202				
200				
198				
196				
194				
192				

* DESIGNATE "A" (ANALOG) or "D" (DIGITAL) FOR EACH CHANNEL PAIR.

SYSTEM CONSTANTS															
REF CHAN	ID	CHAN INTVL	TIME				SCAN INTVL				NEXT SCAN				
			D	H	M	S	D	H	M	S	D	H	M	S	

Form No. 504PD

PROGRAMMING WORKSHEET NO. 2

ALARM SETPOINT SPECIFICATION

ESTERLINE ANGUS
A UNIT OF ESTERLINE CORPORATION

TYPE	HI ALARM SETPOINT
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	

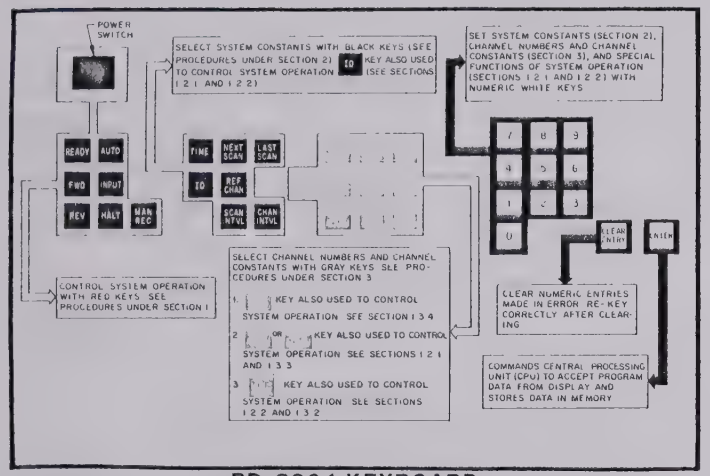
TYPE	LO ALARM SETPOINT
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	

CHAN NO.	TYPE	
	HI	LO
031		
030		
029		
028		
027		
026		
025		
024		
023		
022		
021		
020		
019		
018		
017		
016		
015		
014		
013		
012		
011		
010		
009		
008		
007		
006		
005		
004		
003		
002		
001		
000		

CHAN NO.	TYPE	
	HI	LO
063		
062		
061		
060		
059		
058		
057		
056		
055		
054		
053		
052		
051		
050		
049		
048		
047		
046		
045		
044		
043		
042		
041		
040		
039		
038		
037		
036		
035		
034		
033		
032		

CHAN NO.	TYPE	
	HI	LO
095		
094		
093		
092		
091		
090		
089		
088		
087		
086		
085		
084		
083		
082		
081		
080		
079		
078		
077		
076		
075		
074		
073		
072		
071		
070		
069		
068		
067		
066		
065		
064		

CHAN NO.	TYPE	
	HI	LO
127		
126		
125		
124		
123		
122		
121		
120		
119		
118		
117		
116		
115		
114		
113		
112		
111		
110		
109		
108		
107		
106		
105		
104		
103		
102		
101		
100		
099		
098		
097		
096		


POWER SWITCH
SELECT SYSTEM CONSTANTS WITH BLACK KEYS (SEE PROCEDURES UNDER SECTION 2) TO CONTROL SYSTEM OPERATION (SECTIONS 1 2 1 AND 1 2 2)
ID KEY ALSO USED (SEE SECTIONS
SET SYSTEM CONSTANTS (SECTION 2), CHANNEL NUMBERS AND CHANNEL CONSTANTS (SECTION 3), AND SPECIAL FUNCTIONS OF SYSTEM OPERATION (SECTIONS 1 2 1 AND 1 2 2) WITH NUMERIC WHITE KEYS
READY
AUTO
FWD
INPUT
REV
HALT
MAN REC
TIME
NEXT SCAN
LAST SCAN
ID
REF CHAN
SCAN INTVL
CHAN INTVL
CLEAR ENTRY
ENTER
CONTROL SYSTEM OPERATION WITH RED KEYS SEE PROCEDURES UNDER SECTION 1
SELECT CHANNEL NUMBERS AND CHANNEL CONSTANTS WITH GRAY KEYS SEE PROCEDURES UNDER SECTION 3
KEY ALSO USED TO CONTROL SYSTEM OPERATION SEE SECTION 1 3 4
OR
KEY ALSO USED TO CONTROL SYSTEM OPERATION SEE SECTIONS 1 2 1 AND 1 3 3
KEY ALSO USED TO CONTROL SYSTEM OPERATION SEE SECTIONS 1 2 2 AND 1 3 2
CLEAR NUMERIC ENTRIES MADE IN ERROR RE-KEY CORRECTLY AFTER CLEARING
COMMANDS CENTRAL PROCESSING UNIT (CPU) TO ACCEPT PROGRAM DATA FROM DISPLAY AND STORES DATA IN MEMORY

PD-2064 KEYBOARD

HOW TO USE FLOW DIAGRAM

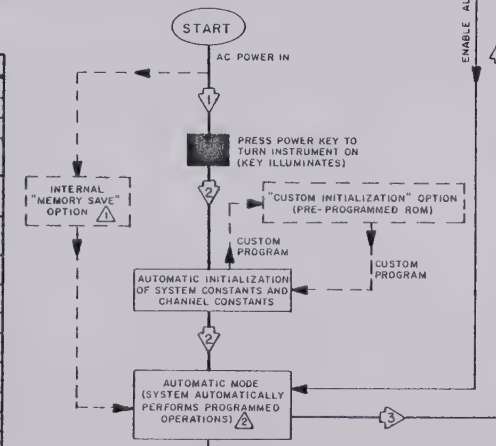
FIRST- Refer to KEYBOARD FUNCTION CHART and select desired functions to be performed.

SECOND- Follow flow route numbers corresponding to selected function.

THIRD- Perform designated programming procedures as you progress along the flow routes.

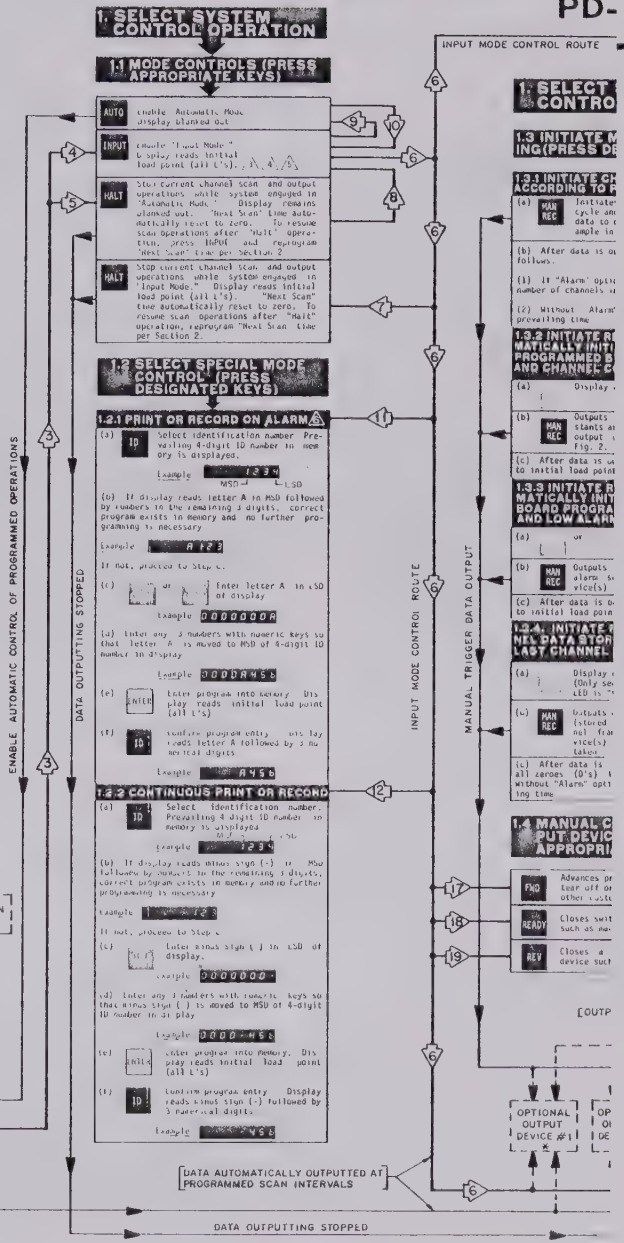
KEYBOARD FUNCTION CHART

FUNCTION	FOLLOW FLOW ROUTE #
Instrument turn-on	1
Automatic Mode	1-3
Input Mode	1-4, 6
Halt channel scan and output operations while system engaged in "Automatic Mode"	1-3, 5
Halt channel scan and output operations while system engaged in "Input Mode"	1-4, 6-7
Enable "Input Mode" after halt operation in "Automatic Mode"	1-3, 5, 8
Switch from "Input Mode" to "Automatic Mode"	1-4, 9
Switch from "Automatic Mode" to "Input Mode"	1-4 or 1-4, 9-10
Select Mode Control	1-4, 6, 11 or 1-4, 6, 12
Initialize Input Mode(s)	1-4, 6, 13 or 1-4, 6, 14 or 1-4, 6, 15 or 1-4, 6, 16
Manual control of output device(s)	1-4, 6, 17 or 1-4, 6, 18 or 1-4, 6, 19
Select system controls	1-4, 6
	1-4, 6
	1-4, 6, 20-21
	1-4, 6, 20, 22
	1-4, 6, 20, 23
	1-4, 6, 20, 24

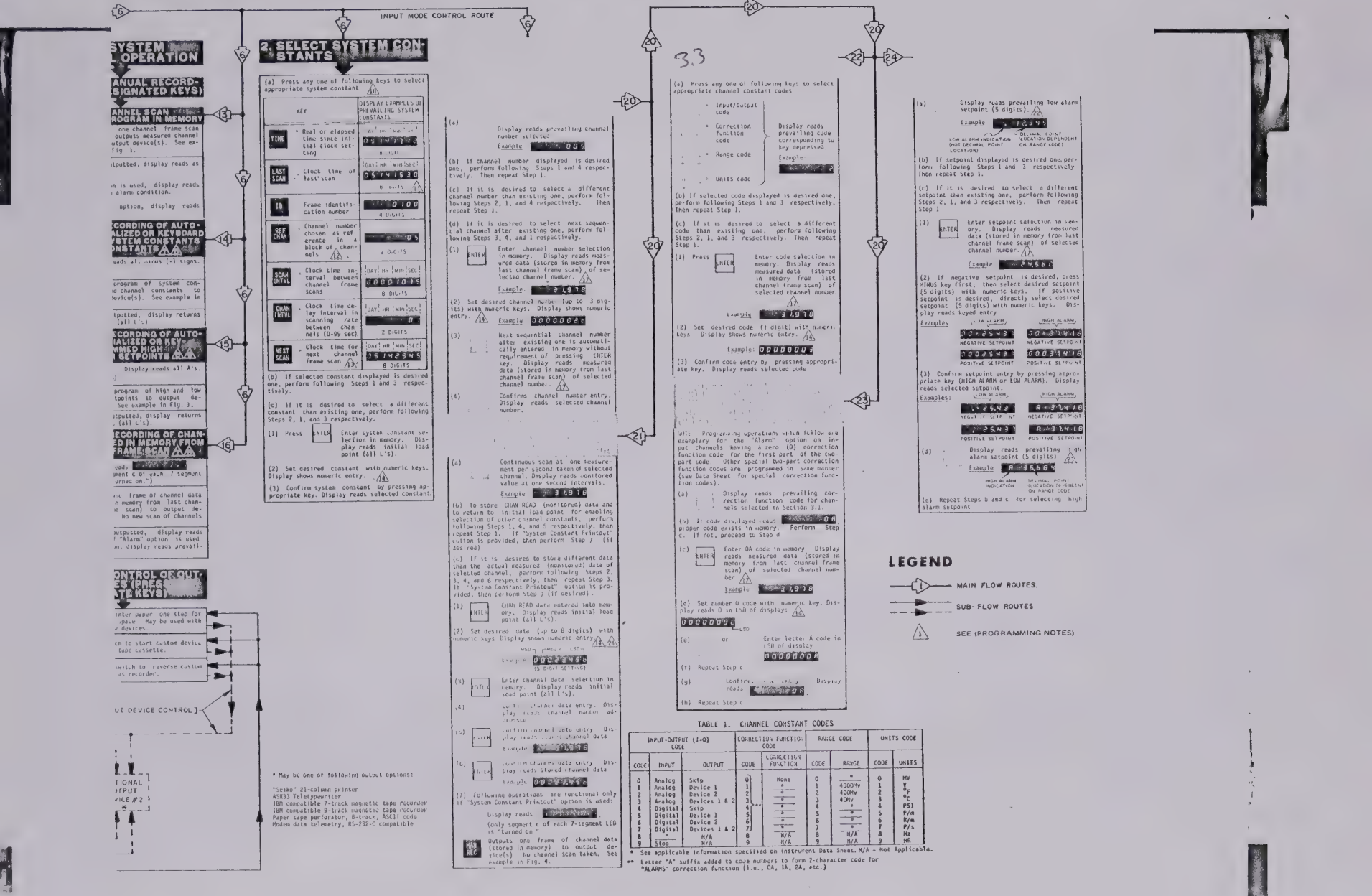

START
AC POWER IN
PRESS POWER KEY TO TURN INSTRUMENT ON (KEY ILLUMINATES)
INTERNAL "MEMORY SAVE" OPTION
"CUSTOM INITIALIZATION" OPTION (PRE-PROGRAMMED ROM)
CUSTOM PROGRAM
CUSTOM PROGRAM
AUTOMATIC INITIALIZATION OF SYSTEM CONSTANTS AND CHANNEL CONSTANTS
AUTOMATIC MODE (SYSTEM AUTOMATICALLY PERFORMS PROGRAMMED OPERATIONS)

PD-2064 FDKP-1

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1. SELECT SYSTEM CONTROL OPERATION
1.1 MODE CONTROLS (PRESS APPROPRIATE KEYS)
AUTO
INPUT
HALT
HALT
1.2 SELECT SPECIAL MODE CONTROL (PRESS DESIGNATED KEYS)
1.2.1 PRINT OR RECORD ON ALARM
1.2.2 CONTINUOUS PRINT OR RECORD
ENABLE AUTOMATIC CONTROL OF PROGRAMMED OPERATIONS
DATA OUTPUTTING STOPPED
INPUT MODE CONTROL ROUTE
MANUAL TRIGGER DATA OUTPUT
INPUT MODE CONTROL ROUTE
DATA AUTOMATICALLY OUTPUTTED AT PROGRAMMED SCAN INTERVALS
DATA OUTPUTTING STOPPED
OPTIONAL OUTPUT DEVICE #1

2064 OPERATIONAL FLOW DIAGRAM AND KEYBOARD PROGRAMMING


INPUT MODE CONTROL ROUTE
2. SELECT SYSTEM CONSTANTS
(a) Press any one of following keys to select appropriate system constant
KEY
DISPLAY EXAMPLES OF PREVAILING SYSTEM CONSTANTS
TIME
Real or elapsed time since initial clock setting
LAST SCAN
Clock time of last scan
IB
Frame identification number
4 DIGITS
REF CHAN
Channel number chosen as reference in a block of channels
2 DIGITS
SCAN INTVL
Clock time interval between channel frame scans
8 DIGITS
CHAN INTVL
Clock time delay interval in scanning rate between channels (0-99 sec).
2 DIGITS
NEXT SCAN
Clock time for next channel frame scan
8 DIGITS
(b) If selected constant displayed is desired one, perform following Steps 1 and 3 respectively.
(c) If it is desired to select a different constant than existing one, perform following Steps 2, 1, and 3 respectively.
(1) Press ENTER. Enter system constant selection in memory. Display reads initial load point (all L's).
(2) Set desired constant with numeric keys. Display shows numeric entry.
(3) Confirm system constant by pressing appropriate key. Display reads selected constant.
3.3
(a) Press any one of following keys to select appropriate channel constant codes
Input/Output code
Correction function code
Range code
Units code
Display reads prevailing code corresponding to key depressed.
Example
(b) If selected code displayed is desired one, perform following Steps 1 and 3 respectively. Then repeat Step 1.
(c) If it is desired to select a different code than existing one, perform following Steps 2, 1, and 3 respectively. Then repeat Step 1.
(1) Press ENTER. Enter code selection in memory. Display reads measured data (stored in memory from last channel frame scan) of selected channel number.
Example
(2) Set desired code (1 digit) with numeric keys. Display shows numeric entry.
Example:
(3) Confirm code entry by pressing appropriate key. Display reads selected code
With Programming operations which follow are exemplary for the "Alarm" option on input channels having a zero (0) correction function code for the first part of the two-part code. Other special two-part correction function codes are programmed in same manner (see Data Sheet for special correction function codes).
(a) Display reads prevailing correction function code for channels selected in Section 3.1.
(b) If code displayed reads proper code exists in memory. Perform Step c. If not, proceed to Step d
(c) Enter OA code in memory. Display reads measured data (stored in memory from last channel frame scan) of selected channel number
Example
(d) Set number 0 code with numeric key. Display reads 0 in LSD of display:
LSD
(e) or Enter letter A code in LSD of display
(f) Repeat Step c
(g) Confirm. Display reads
(h) Repeat Step c
(a) Display reads prevailing low alarm setpoint (5 digits).
Example
LOW ALARM INDICATION (NOT DECIMAL POINT LOCATION)
DECIMAL POINT LOCATION DEPENDENT ON RANGE CODE
(b) If setpoint displayed is desired one, perform following Steps 1 and 3 respectively Then repeat Step 1.
(c) If it is desired to select a different setpoint than existing one, perform following Steps 2, 1, and 3 respectively. Then repeat Step 1
(1) ENTER Enter setpoint selection in memory. Display reads measured data (stored in memory from last channel frame scan) of selected channel number.
Example
(2) If negative setpoint is desired, press MINUS key first; then select desired setpoint (5 digits) with numeric keys. If positive setpoint is desired, directly select desired setpoint (5 digits) with numeric keys. Display reads keyed entry
Examples
LOW ALARM
HIGH ALARM
NEGATIVE SETPOINT
POSITIVE SETPOINT
(3) Confirm setpoint entry by pressing appropriate key (HIGH ALARM or LOW ALARM). Display reads selected setpoint.
Examples:
(d) Display reads prevailing high alarm setpoint (5 digits)
Example
HIGH ALARM INDICATION
DECIMAL POINT LOCATION DEPENDENT ON RANGE CODE
(e) Repeat Steps b and c for selecting high alarm setpoint
(a) Display reads prevailing channel number selected
Example
(b) If channel number displayed is desired one, perform following Steps 1 and 4 respectively. Then repeat Step 1.
(c) If it is desired to select a different channel number than existing one, perform following Steps 2, 1, and 4 respectively. Then repeat Step 1.
(d) If it is desired to select next sequential channel after existing one, perform following Steps 3, 4, and 1 respectively.
(1) ENTER Enter channel number selection in memory. Display reads measured data (stored in memory from last channel frame scan) of selected channel number.
Example
(2) Set desired channel number (up to 3 digits) with numeric keys. Display shows numeric entry.
Example
(3) Next sequential channel number after existing one is automatically entered in memory without requirement of pressing ENTER key. Display reads measured data (stored in memory from last channel frame scan) of selected channel number.
(4) Confirms channel number entry. Display reads selected channel number.
(a) Continuous scan at one measurement per second taken of selected channel. Display reads monitored value at one second intervals.
Example
(b) To store CHAN READ (monitored) data and to return to initial load point for enabling selection of other channel constants, perform following Steps 1, 4, and 5 respectively, then repeat Step 1. If "System Constant Printout" option is provided, then perform Step 7 (if desired)
(c) If it is desired to store different data than the actual measured (monitored) data of selected channel, perform following Steps 2, 3, 4, and 6 respectively, then repeat Step 3. If "System Constant Printout" option is provided, then perform Step 7 (if desired).
(1) ENTER CHAN READ data entered into memory. Display reads initial load point (all L's).
(2) Set desired data (up to 8 digits) with numeric keys Display shows numeric entry.
MSD
LSD
Example
(8 DIGIT SETTING)
(3) ENTER Enter channel data selection in memory. Display reads initial load point (all L's).
(4) Confirm channel data entry. Display reads channel number addressed
(5) ENTER Confirm channel data entry. Display reads stored channel data
Example
(6) ENTER Confirm channel data entry. Display reads stored channel data
Example
(7) Following operations are functional only if "System Constant Printout" option is used:
Display reads
(only segment c of each 7-segment LED is "turned on")
MAN REC Outputs one frame of channel data (stored in memory) to output device(s) No channel scan taken. See example in Fig. 4.
TABLE 1. CHANNEL CONSTANT CODES
INPUT-OUTPUT (I-O) CODE
CORRECTION FUNCTION CODE
RANGE CODE
UNITS CODE
CODE
INPUT
OUTPUT
CORRECTION FUNCTION
RANGE
UNITS
Analog Skip
Analog Device 1
Analog Device 2
Analog Devices 1 & 2
Digital Skip
Digital Device 1
Digital Device 2
Digital Devices 1 & 2
N/A
Stop
None
4000Mv
400Mv
40Mv
mV
V
°F
°C
PSI
P/m
R/m
P/s
Hz
HR
* See applicable information specified on Instrument Data Sheet. N/A - Not Applicable.
** Letter "A" suffix added to code numbers to form 2-character code for "ALARMS" correction function (i.e., OA, 1A, 2A, etc.)
LEGEND
MAIN FLOW ROUTES.
SUB-FLOW ROUTES
SEE (PROGRAMMING NOTES)
* May be one of following output options:
"Seiko" 21-column printer
ASR33 Teletypewriter
IBM compatible 7-track magnetic tape recorder
IBM compatible 9-track magnetic tape recorder
Paper tape perforator, 8-track, ASCII code
Modem data telemetry, RS-232-C compatible

PROGRAMMING NOTES

NOTES:

1. "Memory Save" option activated upon loss of AC power at power input source. Programmed operations placed in memory are sustained for approximately 10 minutes by internal battery power. System reverts to "Automatic Mode" of operation except channel scanning and data outputting operations are inhibited.

2. In "Automatic Mode," system control functions as follows: (1) power interrupted from output device(s) for time period between scans, (2) display blanked out; (3) clock continues operating and central processing unit continues to function, (4) keyboard functionally disabled.

3. If "System Constant Printout" option is used, proceed to Section 1.3.2 to observe printout record of automatically initialized constants. Constants automatically initialized should appear as shown in Fig. 2. If "Custom Initialization" option is omitted. If "Custom Initialization" option is included, printout record should conform to customized system and channel constants as specified on the instrument Data Sheet. If "System Constant Printout" option is omitted, automatically initialized constants may be viewed on display by following procedures in Table 2.

4. If system constant Printout and "Alarm" options are used, proceed to Section 1.3.3 to observe printout record of automatically initialized high and low alarm setpoints. Setpoints automatically initialized should appear as shown in Fig. 3 if "Custom Initialization" option is omitted. If "Custom Initialization" option is included, printout record should conform to customized alarm setpoints as specified on the instrument Data Sheet. If "System Constant Printout" option is omitted when "Alarm" option is used, automatically initialized setpoints may be viewed on display by following procedures in Table 2.

5. In Input Mode, system control functions as follows (1) power applied to all circuits; (2) display turned on; (3) keyboard becomes functional for programming operations, (4) system completely operational.

6. These programming operations become functional only if "Alarm" option is used.

7. These programming operations become functional only if "System Constant Printout" option is used.

8. To initiate proper recording results, display must read initial load point (all L's) prior to execution of these programming steps. To obtain initial load point, press any one of the channel constant keys (I-O, CORR FUNCT, RANGE, or UNITS) either once or twice until all L's appear in display.

9. These programming operations become functional only if "System Constant Printout" and "Alarm" options are used.

10. To avoid being rushed in the completion or check of system constant programming steps prior to initiation of "Next Scan" time, always program "Next Scan" time as the last step.

11. If no previous channel frame scan has been made since instrument turn on, display reads all zeroes (0's).

12. Typical use, to select thermocouple cold junction reference location, may be used as similar function with other custom programs.

13. First scan after instrument "turn on" is made according to programmed time entry for "Next Scan." For subsequent channel scans, "Next Scan" time is automatically updated by the programmed "Scan Intvl" time increment. System will not automatically scan until "Next Scan" time is reached.

14. If error is made when selecting numeric entry, press CLEAR (CLR) key, then re-select correct numeric entry.

15. Also refer to topic heading "Special Keyboard Programming Routines" in instruction manual.

16. Unless otherwise noted, all channel numbers and channel constants are selected per channel pair basis (i.e. channels 0 & 1, 2 & 3, 4 & 5, etc.). Channel pairs start with even numbers.

17. If no channel frame scans have been made since instrument "turn on," display reads all zeroes (0's) or 00010000.
(Decimal point location dependent on range code)

18. These programming operations functionally valid for analog input channels only (not valid for digital input channels).

19. See Table 1 for channel constant codes.

20. These programming operations become functional only if "Alarm" option is used.

21. High and low alarm setpoints are programmable per individual channel basis.

22. If no previous low alarm setpoint has been entered in memory, exemplary display reads 0 .000000.

23. If no previous high alarm setpoint has been entered in memory, exemplary display reads 0A000000.

24. Although 8 digits of data may be entered into memory by numeric keys, printer output device is capable of printing only 7 digits (LSD through MSD-1 on display. MSD is not printed).

TABLE 2. SYSTEM CONSTANTS AND CHANNEL CONSTANTS AUTOMATICALLY INITIALIZED AT INSTRUMENT "TURN ON" (WITHOUT "CUSTOM INITIALIZATION" OPTION) (1)

	PRESS FOLLOWING KEY	DISPLAY
CHECK SYSTEM CONSTANTS INITIALIZED	TIME	Elapsed time since instrument "turn on." Example. 00000003 3 SEC
	NEXT SCAN	Time for next channel frame scan. 00010000 1 HR
	LAST SCAN	Time of last channel frame scan. All zeroes indicate that no previous scan has been made yet. (2) 00000000
	ID	Identification number 0000
	REF CHAN	Reference channel number 00
	SCAN INTVL	Time between channel frame scans 00010000 1 HR
	CHAN INTVL	Time delay in scanning rate between channels. 00 0 SEC
CHECK CHANNEL NUMBER SELECTION AND CHANNEL CONSTANTS INITIALIZED (FOLLOW PROCEDURES IN SEQUENCE GIVEN)	(1) CHAN SELECT	Channel number selected 000
	(2) ENTER	00000000 displayed for even-numbered channels between 0 and 24, and all channels above 24. (3)(4)(5) 00010000 displayed for odd-numbered channels between 0 and 24. (3)(4)(5)
	(3) I-O	Input/output code (6)
	(4) ENTER	Same as Step 2.
	(5) CORR FUNCT	Correction function code. (6) 0
	(6) ENTER	Same as Step 2.
	(7) RANGE	Range code (6)
	(8) ENTER	Same as Step 2.
	(9) UNITS	Units code (6) 0
	(10) ENTER	Same as Step 2.
	(11) HIGH ALARM	High alarm setpoint (5) (7) (8) HIGH ALARM INDICATION 0A000000
	(12) ENTER	Same as Step 2. (9)
	(13) LOW ALARM	Low alarm setpoint. (5) (10) (8) 0 .000000 LOW ALARM INDICATION (NOT DECIMAL POINT)
	(14) ENTER	Same as Step 2. (9)
	(15) CHAN SELECT	Same as Step 2.
	(16) CHAN SELECT	Channel number selected 001
	(17) ENTER	Same as Step 2.
	(18) Repeat Steps 3 thru 14.	Same for each Step repeated.
	(19) Repeat Steps 15, 16, and 17 to select next channel, then follow with Steps 3 thru 10 for each channel pair selected and with Steps 11 thru 14 for each individual channel selected	Display will read same for each step repeated. Display for Step 16 increases by one for each next channel selected. Note that channel constant codes are initialized and programmable per channel pair basis (i.e., channels 0 & 1, 2 & 3, 4 & 5, etc.); but high and low alarm setpoints are initialized and programmable per individual channel basis.

NOTES FOR TABLE 2

(1) If "Custom Initialization" option is used, constants displayed should conform to customized system and channel constants as specified on the instrument data sheet.

(2) If channel frame scan has previously been initiated since instrument 'turn on,' display will read time of last scan.

(3) Display reads as indicated if no previous channel frame scan has been initiated since instrument "turn on." If a channel frame scan has been previously initiated since instrument 'turn on,' display will read measured data (of channel number selected) from last scan

Example 26.83 7

(4) If selected channel number has no data storage capability provided in RAM, display reads all 9's.

(5) Decimal point location dependent upon range code.

(6) See Table 1 for channel constant codes.

(7) If "Alarm" option is omitted, display reads 0 000000 (ONLY SEGMENT A OF LED IS TURNED ON)

(8) If selected channel number does not have alarm setpoint storage capability provided in RAM, display reads 9A999999 for high alarm or 9 999999 for low alarm.

(9) If "Alarm" option is omitted, display reads initial load point (all L's).

(10) If "Alarm" option is omitted, display reads all A's.

PRINTOUT EXAMPLES OF "SEIKO" PRINTER

```
Ch015  -29.460 MV
Ch014 . 42.623 MV
Ch013 : 059.25 MV
Ch012 :257.86 MV
Ch011   35.239 V
Ch010   06.500 V
Ch007 :-0243.8 °F
Ch006 : 2850.9 °F
Ch005 0-096.85 °F
Ch004 0 080.62 °F
Ch003 :-0250.4 °C
Ch002 : 1480.6 °C
Ch001 0-1857.9 °C
Ch000 0 0987.3 °C
0000 00 00:43:46 HR
```

Fig. 1. Typical Channel Frame.

```
Ch014  1 0 .1 0 MV
Ch012  1 0 .1 0 MV
Ch010  1 0 .1 0 MV
Ch008  1 0 .1 0 MV
Ch006  1 0 .1 0 MV
Ch004  1 0 .1 0 MV
Ch002  1 0 .1 0 MV
Ch000  1 0 .1 0 MV
Ch***  00.00 MV
0000 00 00:00:03 HR
```

Fig. 2. System Constant and Channel Constant Program Initialization (W/O "Custom Initialization" ROM).

```
Ch015 :99999.9 MV
Ch015 .99999.9 MV
Ch014 :99999.9 MV
Ch014 .99999.9 MV
Ch013 :99999.9 MV
Ch013 .99999.9 MV
Ch012 :99999.9 MV
Ch012 .99999.9 MV
Ch011 :00000.0 MV
Ch011 .00000.0 MV
Ch010 :00000.0 MV
Ch010 .00000.0 MV
Ch009 :00000.0 MV
Ch009 .00000.0 MV
Ch008 :00000.0 MV
Ch008 .00000.0 MV
Ch007 :00000.0 MV
Ch007 .00000.0 MV
Ch006 :00000.0 MV
Ch006 .00000.0 MV
Ch005 :00000.0 MV
Ch005 .00000.0 MV
Ch004 :00000.0 MV
Ch004 .00000.0 MV
Ch003 :00000.0 MV
Ch003 .00000.0 MV
Ch002 :00000.0 MV
Ch002 .00000.0 MV
Ch001 :00000.0 MV
Ch001 .00000.0 MV
Ch000 :00000.0 MV
Ch000 .00000.0 MV
Ch***  00.00 MV
0000 00 00:00:03 HR
```

Fig. 3. Alarm Setpoint Program Initialization (W/O "Custom Initialization" ROM).

```
Ch015 0-30.750 MV
Ch014 . 40.522 MV
Ch013 : 067.31 MV
Ch012 :256.54 MV
Ch011 0023.456 V
Ch010 0004.291 V
Ch007 :-0263.2 °F
Ch006 : 2724.5 °F
Ch005 0-270.05 °F
Ch004 00150.45 °F
Ch003 :-0245.2 °C
Ch002 : 1450.8 °C
Ch001 0-2500.0 °C
Ch000 0 0895.5 °C
0115 00 00:02:13 HR
```

Fig. 4. Channel Frame Printout of CHAN READ (Monitored Channel) Data and Channel Data Set by Numeric Key Entry.

PRINTOUT LEGEND

A - Frame header line.

B - Channel frame scan length. Scan length may be controlled in two ways.

(1) "Stop" input code 9 (see Table 1) programmed for the channel pair immediately following channel pair for which it is desired to stop scan. Channel pair having "Stop" input code is not printed.

Note. To program various channel constant codes, refer to Sections 3.1, 3.3, and 3.4

(2) The number of channels of data that can be stored in RAM. Capacity of each RAM holds memory for 8 channels of data plus channel constants for 8 channels.

C - Channels 8 and 9 skipped.

D - Channel number.

E - Negative polarity

F - High alarm indication.

G - Overrange indication

H - Data.

I - Alarm setpoints. All 9's printout denotes no alarm setpoint storage capability provided in RAM for corresponding channel.

J - Measurement units.

PRINTOUT LEGEND (Cont'd.)

K - Time (real or elapsed time since initial clock setting day, hr, min, sec).

L - Frame identification

M - Auxiliary header line.

N - Input/output code (see Table 1)

O - Low alarm indication.

P - Correction function code (see Table 1)

Q - Separator dot

R - Range code (see Table 1),

S - Measurement units code (see Table 1)

T - Reference channel number

U - Channel interval time (0-99 sec.)

V - Channel data entered with numeric keys. Although 8 digits of data may be entered into memory by numeric keys, printer is capable of printing only 7 digits (LSD through MSD-1 on display. MSD is not printed.)

W - CHAN READ (monitored channel) data entry

X - Frame header line reads same data as recorded on last channel frame scan

SECTION 4 - APPENDIX

The Appendix section of this manual contains a variety of information which may best be summarized by the contents listing below.

C O N T E N T S

SECTION	DESCRIPTION
A	Technical specifications of instrument
B	Optional output devices that can be interfaced with the PD-2064 data system
C	Accommodation of optional signal inputs
D	Accommodation of various miscellaneous system options
E	Explanation of terms which are used in textual content of manual
F	Servicing procedures
G	Supplemental instructions covering optional features and other special instrument modifications requested by the purchaser
H	Manual revisions covering production changes and correction notices. The production change notices describe the latest design improvements; whereas, the correction notices give the corrections for any prevailing errors in the manual.
TECHNICAL DATA ENVELOPE (Rear of Manual)	The "Technical Data" envelope labeled IMPORTANT contains the PD-2064 simplified programming guide (wheel) and the data sheets which accurately describe the customized system configuration of the instrument supplied. Refer to these data sheets for a description of your instrument, the accessories supplied, the serial number, and any special assembly numbers. Always keep material in this envelope for handy reference. DO NOT misplace.

SECTION A — PD-2064 SPECIFICATIONS

A.1 PROGRAMMING MODES

Standard Programming: Keyboard-controlled microprocessor. Manual entry through keyboard controls system operation and sets program for system constants, channel constants, and optional alarm setpoints. Keyboard entering of program can be used to override auto-programming option, if desired.

Auto-Programming Option: Instructions preprogrammed at the factory according to user specifications automatically sets program for system constants, channel constants, and optional alarm setpoints. Programs are automatically initialized when power is turned on. Refer to paragraph 3.5.1 in "Operation" section of manual.

A.2 INPUT SPECIFICATIONS

NUMBER OF CHANNELS:

Analog: 8 channels per mux card up to 248 total channels (31 mux cards). Main and auxiliary card cages on PD-2064 can accommodate up to 32 analog channels when digital BCD input option is included and up to 64 analog channels when digital input option is excluded.

Digital (Optional): 1 channel per mux card up to 16 total channels (16 mux cards). Refer to paragraph C.2.2 in "Appendix" (Section C) of manual.

Analog Input Configuration: 3-pole reed relay; switches Hi, Lo, and isolated guard circuit on each channel.

Input Guarding: Isolation of analog inputs from other analog inputs, ground, digital inputs, and digital logic is provided by continuous guard shield. The entire analog signal path is enclosed in a floating, guarded enclosure which is connected to the guard terminal of each input channel in turn during data sampling.

Standard Input Ranges: ±40mV, ±400mV, and ±4000mV; ±4000mV maximum direct input, 200V maximum with voltage dividers; inputs above standard calibrated values (overrange) are indicated in the display and output by notational symbol or character; optional ranges available. Consult Factory.

Input Protection: 120V RMS AC, 200V DC.

Resolution: 40,000: 1 overall; 1 microvolt minimum (on 40mV range).

Sample Period: Factory selectable; 16-2/3 milliseconds (one cycle of 60Hz) or 20 milliseconds (one cycle of 50 Hz).

A/D Converter: 4.4 digit, dual-slope integration. Line frequency pickup neutralization by 1/frequency = sample period.

Input Impedance: 100 megohm minimum on all voltage ranges with direct input (no voltage dividers).

Maximum Source Impedance: 5,000 ohms for rated accuracy.

Common Mode Voltage: (Maximum Rated): ±200V DC, or 125V RMS AC; Restricted to 200V peak per mux card or between channels.

Common Mode Rejection: 120db(10^6:1) nominal @ DC; 130db for systems of 32 channels or less, 110db for systems of 200 channels or more; 100db (10^5:1) min. @ line frequency.

Normal Mode Rejection: 60db (1000:1) min. @ line frequency; Restriction: Gain (input voltage + normal mode voltage) $\leq$ ±4 volts.

Residual Charge Effect: No noticeable effect on successive channel readings with any combination of signals within measurement ranges of PD-2064.

ACCURACY:

With Ambient Temperature @ 25°C ± 5°C:

±0.01% of reading, ±0.015% full scale, ± 1 count on 4000mV range;
±0.01% of reading, ±0.03% full scale, ± 1 count on 400mV range;
±0.01% of reading, ±0.04% full scale, ± 1 count on 40mV range.

Over Full Operating Ambient Temperature Range of 0 to 50°C:

±0.5µV per °C, ±0.01% of reading, ±0.04% full scale, ± 1 count on all ranges.

A.3 TIMING AND CONTROL SPECIFICATIONS

Clock: Crystal-controlled, 100-day clock is standard; maximum readout is 99 days, 23 hours, 59 minutes, and 59 seconds. Time is outputted at beginning of each data frame output cycle. Standard accuracy = ±0.0025%. Accuracy of high-stability clock option = ±0.0001%.

Scan Rate: Analog inputs are sampled sequentially, digitized, and stored in memory. Scan rate is independent of output device speed. Scan rate is related to data reading due to the "discharge slope" time of the dual-slope integrator being proportional to the signal level. The table below gives representative values:

Average Data Reading	Scan Rate
00000 counts	25 chan./sec.
10000 counts	19 chan./sec.
20000 counts	14.5 chan./sec.
40000 counts	10 chan./sec.

Frame Cycle (Throughput) Rate: Total cycle time is a function of the time required to input all data and output the data to the output device(s). An example is given below with channel interval time set to zero:

Scan time--24 channels of 10000 count data . . . . . = 1.2 sec.
Seiko print time--24 channels plus frame header line . . . . . = 6.8 sec.
RS-232-C output time--24 channels plus frame header line @ 1200 baud . = 4.3 sec.
Total frame cycle time . . . . . =12.3 sec.

This represents the minimum time between successive readings of the same input channels on a system configured as described. Digital input scan time (if applicable) must also be added to the analog scan time and output device(s) cycle time(s) to obtain frame cycle time. Digital input scanning is at the rate of 100 chan./sec. maximum if all signals are available at time of sampling.

Frame Scan Interval Control: Adjustable from 1 second to 99 days, 23 hours, 59 minutes, 59 seconds by key-setting. "Scan Interval" key executes this setting.

Channel to Channel Interval Control: Adjustable from 0-99 seconds by key programming. "Channel Interval" key executes this setting. Setting establishes delay time (in full seconds) between end of one channel measurement and beginning of the next.

Automatic Scan Trigger Control: Adjustable from 1 second to 99 days, 23 hours, 59 minutes, 59 seconds. "Next Scan" key executes this setting. Allows user to initiate an automatic scanning sequence at a preset time in future.

Previous Scan Time Check: "Last Scan" key executes this feature. Display indicates time of most recent previous scan.

Frame Identification Number: 4-digit number which is settable by numeric keys and executed by the "ID" key. This number precedes the clock time in the frame header line at the beginning of each data frame output cycle. For some special functions, ID number is used in conjunction with other key operations to select the program.

A.4 PHYSICAL SPECIFICATIONS

BASIC PD-2064 UNIT:

Size: H = 8 3/4" (222mm); W = 17" (432mm); D = 17 1/2" (445mm); also refer to Figure 2-2 in "Installation" section of manual.

Weight: 35 pounds (16 kg.) approximately; contingent on system requirements.

EXPANDER HOUSING:

Size: Same as PD-2064 unit above.

Weight: 16 pounds (7 kg.) approximately; contingent on system requirements.

A.5 DISPLAY

8 digits (including sign and overrange indication) plus floating decimal point. Characters are 7 segment LED. Two modes (with units indicated on bezel) are presented:

Maximum time = 99 days, 23 hours, 59 minutes, 59 seconds.
Typical Data = -39.999 ("L" preceding data indicates overload or overrange condition).

A.6 CHANNEL PROGRAMMING CONTROLS

Channel Scanning Controls: Scan length established by "I-O" key "stop" code which selects "end-of-scan" channel. Individual channel pairs or any group length of channel pairs may be skipped with virtually no time loss. Skip function executed by "I-O" key.

Units Programming: Any of 10 standard engineering units designations may be selected for each channel pair. Standard combinations are: MV, V, ^{o}C, ^{o}F, PSI, P/M, R/M, P/S, Hz and HR. Other sets of 10 are optionally available.

Channel Calibration Settings: "Range" and "Correction Function" keys execute calibration mode for each channel pair. See "Standard Input Ranges" listed above. Thermocouples and any non-standard ranges, linearizations, or calculations are executed by other designated settings of these keys.

A.7 ELECTRICAL SPECIFICATIONS

Power Requirements: 100/120/200/220 or 240V AC (transformer taps), ±10%, 50 or 60 Hz (change by jumper); Burden depends on options. Typical burden with Seiko printer as only output device option is: burden during "Input" mode = 66VA; burden during "Auto" mode = 42VA.

A.8 OPTIONAL OUTPUT DEVICES

(Refer to "Section B" in Appendix of manual. Any two of the same or different type output devices listed below may be interfaced to the PD-2064 at the same time.)

Seiko Printer: 21-column printer with data in columnar format. For further description, refer to paragraph B.3.1 in "Section B" of Appendix.

Paper Tape Recorder Interface: Designed for Facit Model 4070, 8 track perforator, or equal. USACII code utilized. Description and specifications found under paragraph B.3.2 in "Section B" of Appendix.

Incremental Reel-Type Magnetic Tape Recorder Interface: Interfaces available for 7 track and 9 track, IBM compatible tape recorders, BCDIC and EBCDIC codes utilized. Description and specifications found under paragraph B.3.3 in "Section B" of Appendix.

Serial USACII Interface: Designed to drive ASR-33 Teletype and any other device with compatible interface. 20 mA DC current loop output. Description found under paragraph B.3.4 in "Section B" of Appendix.

Data Communication Interface RS-232-C: Designed for compatibility with modems and other conventional data couplers. Serial data transfer, USACII code. Description found under paragraph B.3.5 in "Section B" of Appendix.

Output Device Operating Rates:

Seiko printer	3.5 channels/sec.
Magnetic tape recorder	7 track--16 channels/sec.
	9 track--16 channels/sec.
Paper tape perforator	3.5 channels/sec.
ASR-33 Teletype	0.6 channels/sec.
RS-232-C interface	1200 baud normal (5.5 channels/sec.); Other baud rates available.

A.9 OPTIONAL SIGNAL INPUTS

(Refer to "Section C" in Appendix of manual).

Thermocouple Inputs: Refer to paragraph C.1 in "Section C" of Appendix.

Digital (BCD) Inputs: Refer to paragraph C.2 in "Section C" of Appendix.

Integrator: Provides means of measuring values that represent the time integration of a variety of analog input values rather than the normal instantaneous analog values. Description and specifications found under paragraph C.3 in "Section C" of Appendix.

A.10 MISCELLANEOUS SYSTEM OPTIONS

Alarms[1]: Available in blocks of 8 setpoints for: (1) up to maximum of 120 single setpoints (either high or low) for 120 channel inputs maximum, or (2) up to maximum of 64 dual setpoints (high and low) for 96 channel inputs maximum, or (3) one common high and low alarm setpoint for 232 channel inputs maximum. For further description, refer to paragraph 3.5.3 in "Operation" section of manual.

Alarm Relay Output: Alarm output system can provide 1 common alarm output only, or up to 64 individual channels of alarm output (in multiples of 8 channels) with or without a common alarm output. For further description, refer to paragraph 3.5.3 in "Operation" section of manual.

[1]For standard channel-pair programming system. Also see "Single Channel Programming Option" for alarm capability.

System Constant (Program) Printout: Provides automatic recording of channel-by-channel program settings so that programs may be verified and permanently filed along with measured data. When alarms are present, this option also allows recording of all alarm setpoints. For further description,refer to paragraph 3.5.2 in "Operation" section of manual.

Memory Save: Provides battery-powered carryover[1] through power outages up to approximately 10 minutes to prevent loss of timing and volatile data storage. This is a powered-down mode which causes scope of operations to be limited. See description under paragraph 3.5.4 in "Operation" section of manual.

Internal Reference Source: Precision, built-in reference source has ±20mV, ±200mV, and ±2000mV DC levels (±0.05% accuracy) available for checking individual channels or complete channel system. See paragraph D.1 in "Section D" of Appendix.

Remote Keyboard and Display: Keyboard and display are mounted in a separate enclosure and connected to PD-2064 unit via cable to permit remote operation of data system. Remote control unit performs same functions as display and keyboard on PD-2064. See paragraph D.2 in "Section D" of Appendix.

Keylock: Either "Auto" or "Input" mode of operation can be locked into machine via manually-operated keylock. This lock-in feature automatically prevents: (1) stopping of operational mode (either "Auto" or "Input") with HALT key, and (2) inadvertent or purposeful changing of the operational mode from "Input" to "Auto", or vice versa. See paragraph D.3 in "Section D" of Appendix.

Single Channel Programming Option: Special ROM program allows channel constants to be established on channel-by-channel basis. Standard system allows programming of I-O, range, units, and correction function by pairs of channels. All functions and capabilities are the same for this option as for the standard configuration except: (1) maximum system scanning ability = 124 channels of signal input (without alarms); (2) maximum of 80 single setpoints (either high or low) for 80 channel inputs maximum; (3) maximum of 56 dual setpoints (high and low) for 64 channel inputs maximum; (4) one common high and low alarm setpoint for 116 channel inputs maximum.

A.11 CASE OPTIONS

(Refer to paragraph 2.4 in "Installation" section of manual).

Rack Adapter: The PD-2064 has been designed for mounting in a standard 19-inch (483 mm) instrument rack with the attachment of L-shaped mounting ears on each side. Panel height installed in a rack is 8 3/4 inches (222 mm). Rear support is recommended.

Rack-Mounted Instrument Slides: Option appears identical to rack-adapter mount above, but unit glides in and out on two ball-bearing slides for ease in serviceability.

Carrying Handles: Two sturdy metal handles (one on each side) permit carriage of instrument.

Carrying Case: Use of this case permits transporting the PD-2064 as luggage. Makes field portability easy while protecting against every-day dirt, dust, and abuse.For freight shipment, a sturdier container and/or additional cushioning is required.

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[1]Carryover time is dependent upon the number of RAM devices that are used in a particular system and may be approximated by the following equation:

[Carryover time (in minutes) = 10.5 minutes minus .2 minutes per RAM used in system]

SECTION B - OPTIONAL OUTPUT DEVICES

B.1 GENERAL INFORMATION

a. A number of different output devices may be interfaced to the PD-2064 data system. The following are included among the output device selections available:

(1) "Seiko" digital printer (either internally mounted or externally mounted)

(2) ASR-33 Teletypewriter

(3) Magnetic tape recorders

(4) Paper tape perforator

(5) Data telemetry interface, RS-232-C compatible

b. Any two of the same or different type output devices listed above may be interfaced to the PD-2064 at the same time. The plug-in locations of the appropriate output device interface cards on the PD-2064 chassis are shown in Figure 1-2 of Section 1 in this manual. Interface connections to peripheral output devices are made through interconnecting cables which plug into connectors located on the instrument rear panel.

c. In addition to each dedicated interface card that is installed for a particular output device option, a dedicated control ROM for each output device selected must likewise be plugged into its designated slot on the CPU card as indicated in Figure 1-3. Each output device ROM stores the instructions for properly formatting and controlling the output data to its respective output device. Converting from one type of output device interface to another or adding output interface options may be readily accomplished by simply changing or adding the respective interface plug-in card, plug-in ROM, and external interfacing connector cable for each desired output device.

> NOTE: For information on alarm outputs, refer to paragraph 3.5.3.3 in Section 3 of this manual.

d. Refer to the equipment manufacturer's instruction manual for operating and servicing information covering output device(s) used in system.

B.2 OUTPUTTING CYCLE OF SYSTEM

a. The data outputting cycle occurs in the following sequence:

(1) A complete data scan is made without interruption. If input configuration consists of thermocouple channels, or if some other data conversion program is required, the measured input data is compensated, linearized, and/or otherwise modified.

(2) The entire data scan is then stored in memory.

(3) Outputting of channel data starts according to the programmed input-output (I-O) code for each channel pair.

(4) Output device(s) receive analog channel data first, and then data from optional digital channels (if any).

b. Each output device (either device number 1 or 2) receives the output data in the following sequence: frame header line, specified analog channels (per I-O code), specified digital channels (per I-O code), and then a record separator--such as a line feed for the Seiko printer output option or an inter-record gap for a magnetic tape recorder output option.

c. If two output devices are used (devices number 1 and 2), output data is sequenced according to paragraph b above and is fed to device number 1 first, and then to device number 2.

d. The total output cycle time equals the channel scan time plus the cumulative time required for the output device(s) to receive and handle the data.

e. If "System Constant Printout" (Program Printout") option is used, the system's programmed parameters may also be outputted to each output device. For description of this option, refer to paragraph 3.5.2 in Section 3 of this manual.

> NOTE: In systems utilizing two output devices, the system programming is outputted in duplicate -- first to device number 1, and then to device number 2.

B.3 DESCRIPTION OF OUTPUT DEVICES

The various output device options are described in the following paragraphs.

B.3.1 DIGITAL PRINTER

B.3.1.1 PRINTER SYSTEM SPECIFICATIONS

Model: Seiko Model EP-101.

Column Capacity: Up to 21 columns available; design of PD-2064 uses 16 columns.

Operational Cycle Rate: Approximately 3.5 channels per second.

Standard Engineering Units: MV, V, °F, °C, PSI, P/M, R/M, P/S, Hz, HR.

Ribbon: Ink-impregnated, cloth type; width = 0.5" (13mm); length = 250" (6000mm); either all black or combination red/black available (red/black is standard); ribbon automatically reverses to prolong ribbon life (ribbon life about 1 spool per 3 packs of paper).

Paper: Z-fold (fan-fold) paper pack; length of paper in pack = 220' (67.1 meters); each fold measures 5½" (140mm) long by 3½" (89mm) wide;

Paper Handling Mechanism*: Internal storage compartment for paper pack; slide-out drawer for catching refolded paper.

*Applicable to internally-mounted printer only.

B.3.1.2 GENERAL DESCRIPTION

a. The digital printer may either be mounted within the PD-2064 case enclosure or externally-mounted. The mounting location of the self-contained printer is shown in Figure 1-2 of Section 1 in this manual. An externally-mounted printer is connected to the data system through an appropriate cable which plugs into its respective interface connector on the PD-2064 rear panel.

NOTE: Use of the printer output option requires an installation in which the environmetal air is free from iron filings or particles. If operation of printer is subjected to such an atmosphere, the electromagnets employed in the printer mechanism attract these metal particles which will impede proper operation of the printer.

b. The printer is referred to as a "Flying Drum Printer" type which means that the print drum continuously rotates as the printing operation is being performed. Printing is accomplished by actuation of a print hammer which is caused to strike its corresponding character on the surface of the print drum.

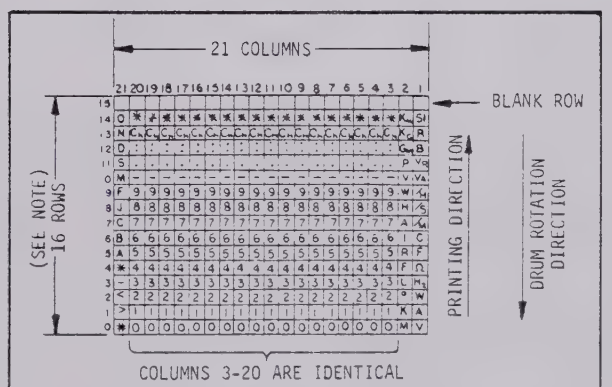

21 COLUMNS
BLANK ROW
(SEE NOTE) 16 ROWS
PRINTING DIRECTION
DRUM ROTATION DIRECTION
COLUMNS 3-20 ARE IDENTICAL
NOTE: WHEN A STANDARD COMBINATION RED/BLACK RIBBON IS USED, CHARACTERS IN ROWS 0 THRU 11 NORMALLY PRINT IN BLACK AND CHARACTERS IN ROWS 12 THRU 14 NORMALLY PRINT IN RED; HOWEVER, WHEN "ALARM" OPTION IS USED, THE LINE PRINTOUTS FOR CHANNELS THAT ARE "IN ALARM" ARE AS FOLLOWS: THOSE CHARACTERS THAT NORMALLY PRINT IN RED NOW PRINT IN BLACK; AND CONVERSELY, THOSE CHARACTERS THAT NORMALLY PRINT IN BLACK NOW PRINT IN RED (EXCEPTION: COLON IN ROW 12 REMAINS PRINTING IN RED). IF AN ALL-BLACK RIBBON IS USED, PRINTING FOR ALL ROWS WILL ALWAYS BE BLACK.
P1380

Figure B-1. Flattened View of Printer Drum Pattern.

c. The printer has the capability of printing 21 columns with each column basically consisting of the printing components shown in Figure B-2B. Although the printer is capable of printing up to 21 columns, only 16 of these available 21 columns are employed in the design of the Model PD-2064.

d. The paper is propelled through the printer by means of two, small, plastic, paper-advance rollers which impress against a single, larger, rubber roller. The rubber roller is driven by a paper-advancing mechanism shown in Figure B-2C.

e. A ribbon transporting attachment (Figure B-4) is mounted atop the main printer mechanism and is easily removed from the front of the mechanism when it becomes necessary to change the printing ribbon.

f. Although optional printing character patterns are available on the print drum, the standard drum pattern used in the Model PD-2064 is shown in Figure B-1. An example of a typical channel frame printout from the printer is shown in Figure 1 on the right-hand foldout sheet of the operational flow diagram (see Section 3 in manual).

B.3.1.3 PRINTING PRINCIPLES

a. Driving power for the printing operation is supplied from a 16V DC transistorized motor shown in Figure B-2A. The motor operates at a speed of 3300 rpm and drives a directly-coupled ratchet shaft at the same speed. The output of the ratchet shaft, in turn, is coupled to a print drum through a 16:1 reducing gear train.

b. As shown in Figure B-1, 16 rows of characters (1 blank row) are spaced equidistantly around the periphery of the print drum. As the ratchet shaft makes one revolution, the 16:1 ratio between the ratchet shaft and the print drum causes the print drum to make 1/16 of a revolution--which, in effect, causes one character row to pass underneath the print hammers for printout. One revolution of the ratchet shaft requires approximately 18ms (60/3300 sec.); therefore, another character row passes underneath the print hammers every 18ms, and the same character row passes underneath the print hammers every 288ms (18ms x 16 rows).

B.3.1.3.1 CHARACTER PRINTOUT

a. The character that is selected to be printed is determined by selecting a trigger pulse which energizes the corresponding column solenoid. The basic printing components involved in the character printout of each column are shown in Figure B-2B.

b. OFF-PRINTING CONDITION: In the off-printing condition, the ratchet shaft and the print drum continuously rotate in the direction of the arrows (clockwise direction). With the column trigger solenoid de-energized, the trigger lever is pulled downward by the tension of its associated spring--beyond the striking distance of the ratchet shaft. The hammer lever is held in a neutral position (upwards) by the tension of its associated spring. Under these conditions the print hammer cannot strike the print drum; therefore, printing will not occur.

c. ON-PRINTING CONDITION: In the on-printing condition, the ratchet shaft and the print drum still continue to rotate as shown in Figure B-2B. Upon energization of the column trigger solenoid, the actuating lever is attracted by the solenoid and is caused to pivot in the clockwise direction. As the actuating lever pivots, it strikes the trigger lever and causes the trigger lever to become engaged with the ratchet shaft. The rotational force of the ratchet shaft (3300 rpm) pivots the trigger lever against the hammer lever which, in turn, causes the print hammer to strike the printing blow against its corresponding character on the print drum. Thus, printing is accomplished through the ink ribbon and onto the paper. Due to negligible contact time between the print hammer and the drum, printing is smear-proof.

d. De-energization of the column trigger solenoid returns all levers back to the "Off-Printing Condition".

B.3.1.3.2 PAPER ADVANCING

a. The paper advancing mechanism shown in Figure B-2C is located on the left side of the printer and is actuated by the paper-advance solenoid.

b. After each line is printed, the solenoid becomes energized and its plunger is drawn inward. Plunger action causes the attached actuating lever to be drawn backward which causes expansion of the paper-advancing spring. As the actuating lever is drawn backward, its associated pawl engages the next tooth in the ratchet wheel.

c. Upon de-energization of the solenoid, the tension of the paper-advance spring pulls the actuating lever forward and causes the pawl to rotate the ratchet wheel in the clockwise direction. Since the rubber paper-advance roller is coaxial with the ratchet wheel, its rotation is coincident with the ratchet wheel. Therefore, the paper is caused to advance between the rubber and plastic paper-advance rollers for printing of the next line.

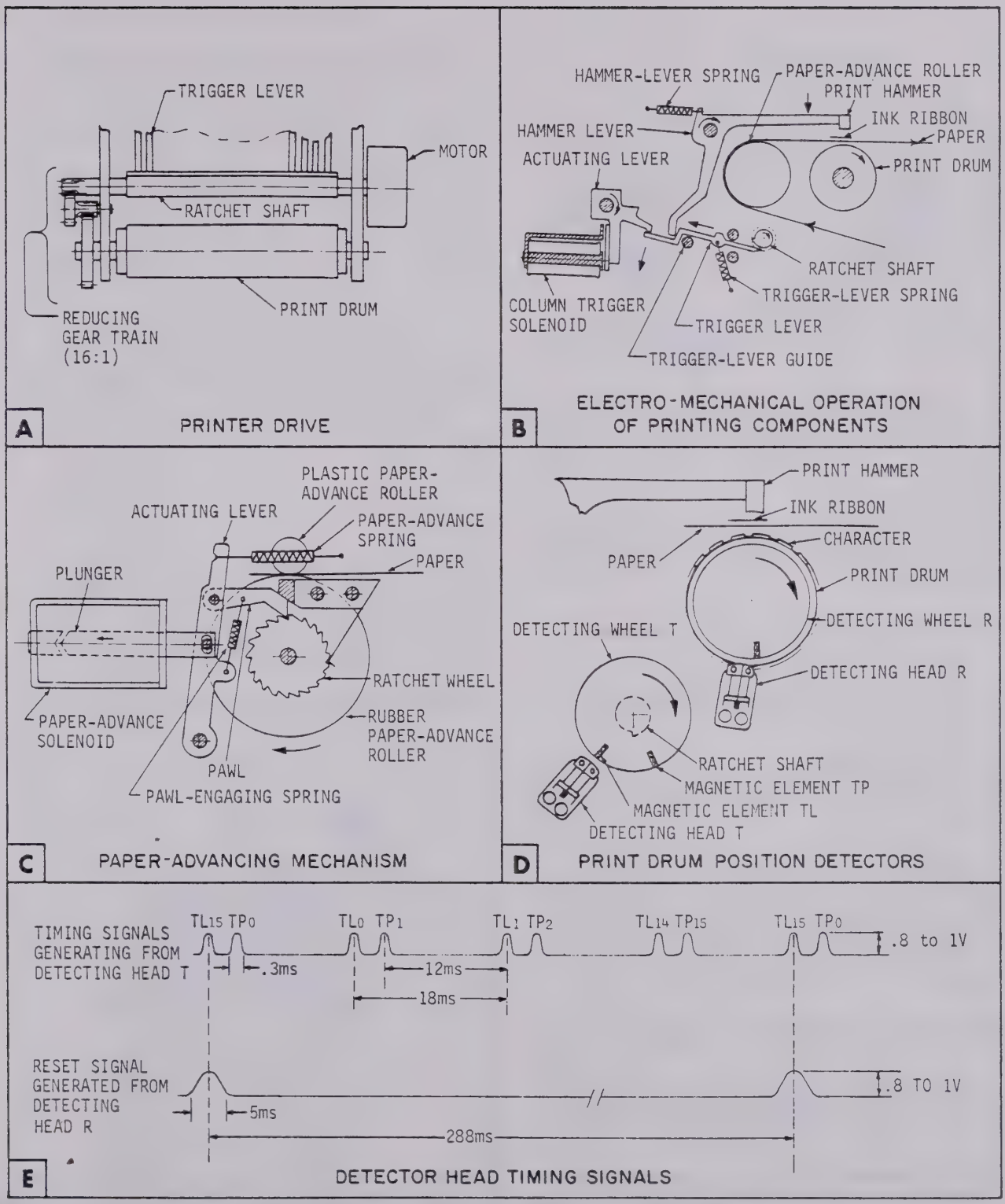


Figure B-2. Digital Printer Operational Details.

B.3.1.3.3 POSITION DETECTORS

a. Timing signals which are used to indicate the position of the printer drum are generated by the detecting heads R and T shown in Figure B-2D. These timing signals are generated electromagnetically by magnetic ferrite chips which are embedded in the detecting wheels R and T. As these magnetic elements pass the detecting heads, voltages are induced in the detecting head coils to provide the voltage- or timing-signal waveforms shown in Figure B-2E.

b. Detecting head R provides a reset (timing) signal every time the print drum completes one revolution.

c. Two timing signals are generated from detecting head T. The timing signal induced by magnetic element TP occurs each time a character row on the print drum passes underneath the print hammers. After each revolution of the print drum, the reset signal generated by detecting head R occurs in coincidence with the TL signal for character row 15. The timing signal induced by magnetic element TL determines the width of the triggering pulses which are used to energize the column trigger solenoids.

B.3.1.4 LOADING OF PRINTER PAPER [1]

> CAUTION: To avoid damaging the print drum, hammers, and inked ribbon, always be sure paper is inserted prior to outputting operations.

a. One pack of paper is supplied with each instrument at shipment. Additional reorders of paper are only supplied in minimum quantities of 12 packs-per-box.

b. Loading of the printer paper is simple and expedient. Detailed instructions for loading the paper is graphically illustrated on a decal affixed to the inside bottom surface of the slide-out drawer that is used to catch the refolded paper. These same instructions are shown in Figure B-3.

c. To load the paper, refer to Figure 3-1 of Section 3 in this manual, and proceed as follows:

(1) Press power key to turn instrument on; then press INPUT key to engage "Input Mode" of operation (display reads all L's); then press HALT key.

> NOTE: Pressing HALT key enables the paper to be loaded without interference from outputting operations by virtue of "Next Scan" time automatically being reset to zero.

(2) Snap out and remove printer access cover. Flip down plastic paper guide/tear-off bar.

(3) Open slide-out drawer to its fully extended position.

(4) Perform the three steps as indicated by the loading instructions on the decal inside the slide-out drawer or as shown in Figure B-3. When performing Step #2, make sure that the "out-of-paper" switch arm (if used) is resting on top of the paper pack.

(5) When performing Step #3 instruction on decal, repeatedly push and release FWD key until paper feeds out front of printer. Route paper underneath tear-off bar, and then flip bar back into its normal position. While holding FWD key pushed in, pull one or two folds of paper from front of printer and tear paper off against plastic bar.

(6) Snap printer access cover back into place. Paper is now loaded and ready for printout operations.

(7) To resume scanning and outputting operations, reprogram "Next Scan" time with NEXT SCAN key per keyboard programming Section 2 on the left-hand, foldout sheet of the operational flow diagram (located in Section 3 of manual). Thereafter, if "Automatic Mode" is desired, press AUTO key.

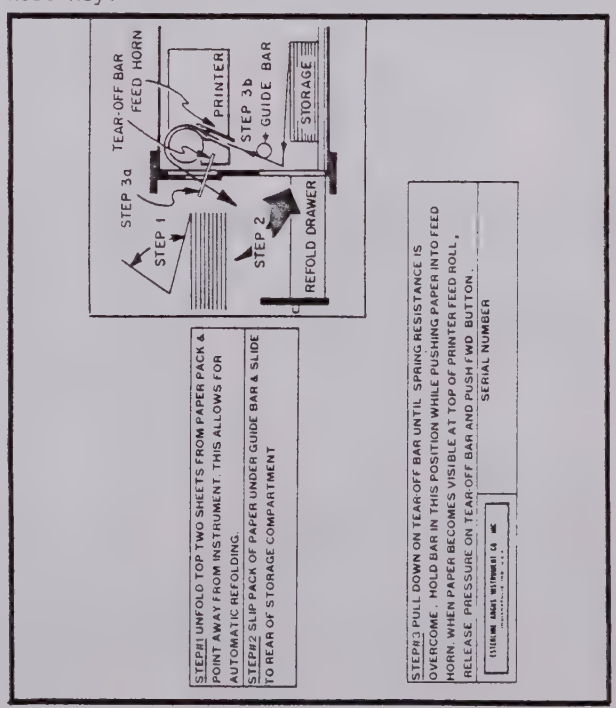

TEAR-OFF BAR
FEED HORN
PRINTER
STEP 3b
GUIDE BAR
STORAGE
STEP 3a
STEP 1
STEP 2
REFOLD DRAWER
STEP#1 UNFOLD TOP TWO SHEETS FROM PAPER PACK & POINT AWAY FROM INSTRUMENT. THIS ALLOWS FOR AUTOMATIC REFOLDING.
STEP#2 SLIP PACK OF PAPER UNDER GUIDE BAR & SLIDE TO REAR OF STORAGE COMPARTMENT
STEP#3 PULL DOWN ON TEAR-OFF BAR UNTIL SPRING RESISTANCE IS OVERCOME. HOLD BAR IN THIS POSITION WHILE PUSHING PAPER INTO FEED HORN. WHEN PAPER BECOMES VISIBLE AT TOP OF PRINTER FEED ROLL, RELEASE PRESSURE ON TEAR-OFF BAR AND PUSH FWD BUTTON.
SERIAL NUMBER
P1382A

Figure B-3. Paper Loading Instructions.

[1] Applicable to paper-handling mechanism used with internally-mounted printer only. Paper must be firm and dry in order to achieve proper loading results.

B.3.1.5 CHANGING PRINTER RIBBON

a. Printing is accomplished through the medium of a conventional, ink-impregnated, cloth ribbon such as commonly used in typewriters and adding machines. The ribbon transporting attachment is an integral part of the printer assembly and is mounted atop the main printer mechanism. The entire ribbon attachment can either be partially withdrawn or completely removed from main printer mechanism for ease of serviceability (see Figure B-4).

b. The printer ribbon spools are supplied with the printer assembly, completely threaded and ready for operation. A combination black and red ribbon is supplied as standard with the printer, although an all-black ribbon is also available upon order. A spare red/black spool of ribbon is also supplied at shipment when data system is equipped with digital printer output. Transport of the ribbon is accomplished by a ribbon-advancing solenoid which mounts on the main printer mechanism.

c. One spool of ribbon will last for a relatively long period of time. When the ribbon on one of the spools is about to run out, its associated sensing lever progressively moves closer and closer towards the hub of the emptying spool. When the ribbon on the emptying spool gets low enough, the sensing lever trips another control lever which, in turn, automatically reverses the direction of ribbon travel between the two spools. This direction reversal of the ribbon is a continuing process that conveniently prolongs the useful life of a spool of ribbon. Due to age and use over an extended period of time, however, the printout quality will deteriorate and a new ribbon should be installed. Average ribbon life is about 1 spool per 3 packs of paper.

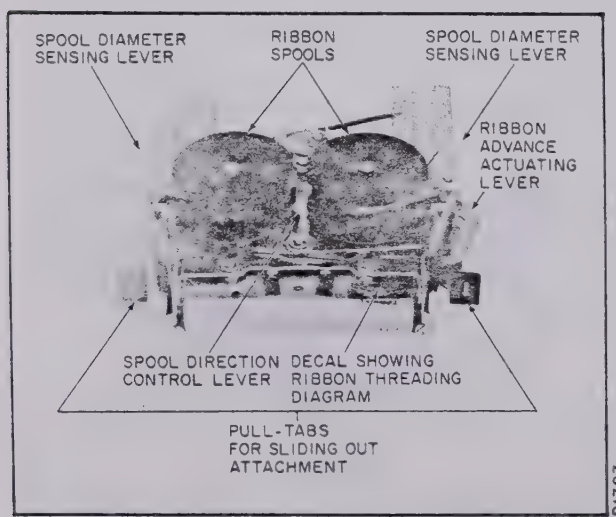


Figure B-4. Ribbon Transport Attachment Removed From Printer Assembly.

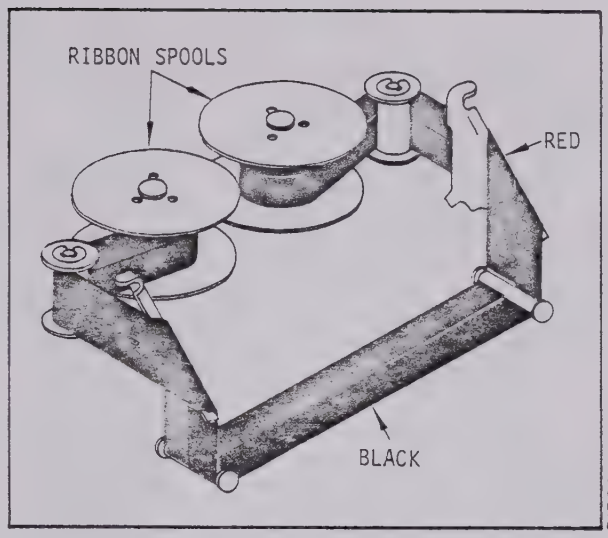


Figure B-5. Ribbon Threading Diagram.

d. Procedures for changing the ribbon are described as follows:[1]

(1) Snap out and remove printer access cover from front panel.

(2) Reach in the printer access opening and grasp the two pull tabs (Figure B-4). Push downward on the tabs and pull the ribbon transport attachment forward through the opening until the mechanism comes to a stop. The ribbon spools are now accessible for changing the ribbon.

> NOTE: If desired, the ribbon transport attachment may be completely removed from the printer as follows: After withdrawing the ribbon attachment to its extended position, push upward on the two pull tabs and pull mechanism straight out.

(3) Pivot the spool diameter sensing levers back out of the way, and remove each spool from its spindle.

(4) Refer to Figure B-5 and remove threaded portion of ribbon from around the various guide pulleys. Discard old ribbon and spools.

(5) To obtain the normal color of character printouts as indicated by notation in Figure B-1, thread new ribbon as shown in Figure B-5. A similar

[1] The references to printer access cover and opening in Steps 1, 2, and 7 apply to an internally-mounted printer.

threading diagram in miniature form is shown on a decal affixed to the mechanism plate (see Figure B-4 for decal location).

> NOTE: If it is desired to reverse printout colors of the character rows from the normal color format (i.e., character rows 0-11 to print red and character rows 12-14 to print black), invert the new spool of ribbon so that black is at the top (reversal of colors shown in Figure B-5) and follow same routing. If an all-black ribbon is used, threading is same as shown in Figure B-5, but all character rows will be printed in black.

(6) After ribbon has been threaded, turn either one of the two spools in the direction that will cause the ribbon to be drawn taut. Slide the ribbon transport attachment back into its normal detented position. If the ribbon attachment was completely removed from the printer, engage the slide-out rails atop the printer mechanism and push the ribbon attachment all the way back into its detented position.

(7) Snap the printer access cover back into place.

B.3.1.6 CLEANING PRINTER

Every 3 months -- or after usage of approximately 10 packs of paper -- the printer should be cleaned with a brush to remove paper chips and dust. Clean the type faces of the print drum with a hard-bristled brush or a needle point. Restrict cleaning agents to either alcohol or benzine (more harsh agents could cause damage to plastic parts consisting of the motor cover, gear cover and paper tear-off bar). Clear printing can be achieved only by maintaining a clean printer.

B.3.1.7 PRINTER OUT-OF-PAPER SWITCH [1]

a. The out-of-paper switch acts as a precautionary measure in preventing inadvertent abuse and possible damage to the printer when the paper supply runs out. On instruments equipped with the optional remote control connector (see paragraph D.4 in "Section D" of manual), circuitry can be devised to provide the external outputting of the out-of-paper signal.

b. Running out of paper without the switch protection can incur possible damage when the print hammers are allowed to strike the print drum, thus causing needless wear of metal surfaces. Other damage may be incurred if the ribbon becomes snagged on the raised characters of the print drum. If this should happen, the ribbon may wrap itself around the print drum, thus stalling the drum and causing either immediate or eventual failure of the print motor.

c. The switch assembly basically consists of a switch-actuating arm and a SPST switch. When paper is loaded into the paper-storage compartment, the switch-actuating arm rests atop the paper pack and free-falls downward as the Z-folds of paper are fed through the printer. When the last fold of paper leaves the storage compartment, the switch is actuated; and then logic circuits act to prevent the column-trigger solenoids from becoming energized. Under this condition, the print drum continues to rotate, but the print hammers are disabled.

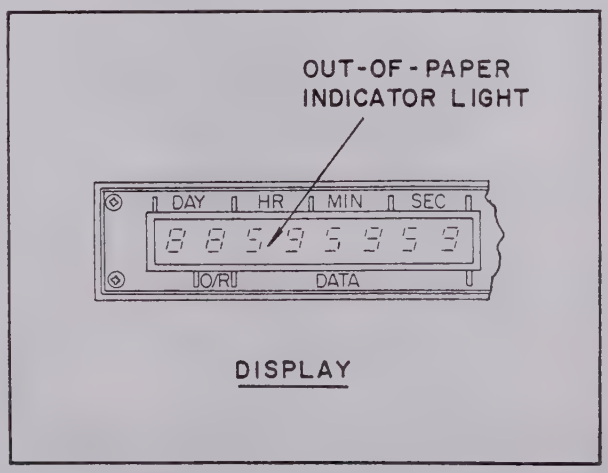
> NOTE: When out-of-paper switch is actuated, a length of paper will not be used and will remain in the printer. Remove this length of paper before loading the next paper pack.

B.3.1.8 PRINTER OUT-OF-PAPER INDICATOR LIGHT [1]

a. This indicator light automatically comes on when the pack of printer paper becomes depleted as sensed by the out-of-paper switch described under paragraph B.3.1.7 above.

b. When the paper supply runs out, the out-of-paper switch is actuated, the indicator light comes on, and the printer ceases to print.

c. The light is located between the HR digits on the display as shown below.



[1] Used only in instruments that have the letter "A" suffixed to the serial number.

B.3.2 PAPER TAPE PERFORATOR

B.3.2.1 PERFORATOR SYSTEM SPECIFICATIONS

Model: Facit Model 4070.

Paper Tape Type: 1" (25.4mm) wide, 8 track, ASR-33 compatible.

Tape Length: 1000' (305 meters).

Character Punch Rate: 65 characters/sec. (approximately).

Character Density: 10 characters/inch (4 characters/cm).

Bench Mount Size: L = 17" (432mm); W = 8 5/8" (219mm); H = 7 1/2" (191mm).

Rack Mount Size: L = 7 3/4" (198mm); W = 19" (483mm); H = 10 1/2" (266mm).

Weight: 29 pounds (13kg.).

AC Power: 100/115/220/240 volts,(+15%, -10%),50 to 100 Hz;50 watts standby, 200 watts maximum.

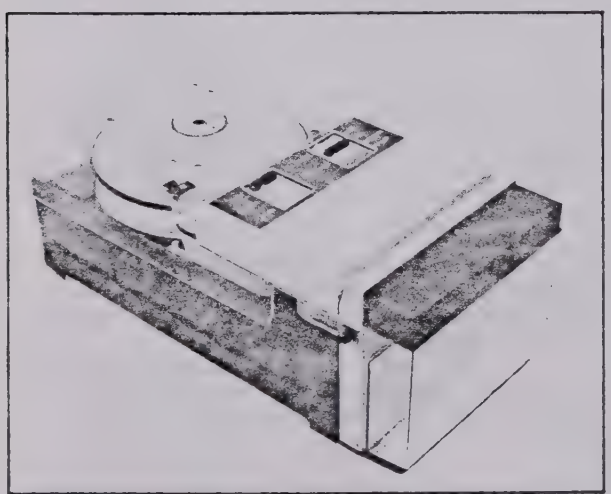
Optional Power: 400 Hz AC power; 24V DC power(+25%, -15%)@ 5 watts standby, 180 watts maximum.

Service Locations: 3 in U.S.A. plus worldwide.

B.3.2.2 GENERAL

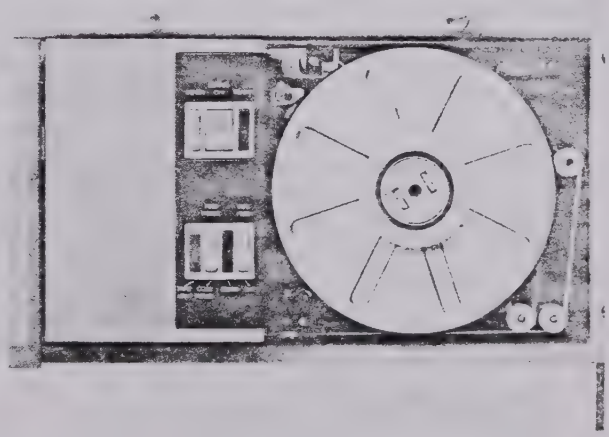
a. Paper tape recording is recommended for recording data in rugged environmental conditions. Although it is slower than magnetic tape recording, it is less delicate and less demanding of a clean operating environment. Visual observance of unit under operating conditions tells the operator whether or not the device is working properly, plus the hole pattern in tape can be read as a final checkpoint to further verify operation. The perforator is available in both bench type and rack mount configurations.

b. Esterline Angus uses a standard paper tape system: one-inch wide tape with 8 rows of data storage, 8 level USASCII code (same as 8 level Teletype). Optional codes are available. Consult factory.



P1399

Figure B-6. Benchmount Configuration--Facit Model 4070 Paper Tape Perforator.



P1400

Figure B-7. Rackmount Configuration--Facit Model 4070 Paper Tape Perforator.

B.3.2.3 INTERFACE CONFIGURATION

a. When the interface for paper tape perforator is employed in the Esterline Angus Model PD-2064, the measured data acquired by the system is converted into coded output signals which are received and punched out by the Facit 4070. The coded output of the interface is formatted into a parallel, 8-level, ASCII code (1968 version) shown in Table B-2. This interface provides a perforated pattern on paper tape that is capable of directly driving an ASR-33 teletype terminal.

b. The output codes generated by the interface option are formatted into: seven data information and control tracks (channels), a parity code track (channel), a punch start signal, and a tape advance signal. Odd, even, or no parity must be specified when ordering. Parity type is preprogrammed in the output interface control ROM (no parity is standard). The interface also accepts signals from the Facit unit for controlling of the outputs when: (1) the punch is ready to operate, (2) the tape supply is low, and (3) the tape is broken or not free to feed properly.

c. Components added to the Model PD-2064 data system for this option include the following (refer to Figure B-8.3 for locations):

(1) A pre-programmed ROM modular circuit (item ROM 5 or ROM 6) that plugs into the central processing unit (CPU) card. This customized integrated circuit contains stored instructions that automatically code and format the measured data before it is outputted to the Facit 4070.

(2) A "Parallel Interface" card (item 1) that plugs into the appropriate output connector (either "OUTPUT 1" or "OUTPUT 2") on the "Digital Mother Board". This card assembly conditions and sequences the output signals to match the input requirements of the Facit instrument.

> NOTE: The plug-in location of the interface card corresponds with the plug-in location of the interface control ROM. Example: If Facit unit is designated as output device #1, the control ROM plugs into Rom 5 position on the CPU card, and the interface card plugs into the "OUTPUT 1" connector on "Digital Mother Board". Likewise, if Facit unit is designated as output device #2, the control ROM plugs into ROM 6 position on the CPU card, and the interface card plugs into the "OUTPUT 2" connector on "Digital Mother Board".

(3) An internal output cable (item 3) that connects the output of the interface card to a connector (item J4) on the PD-2064 rear panel.

(4) An external output cable assembly (item 4) that interconnects the Model PD-2064 and the Facit 4070 (see Figure B-8.). This cable assembly is supplied with data system when Facit unit is furnished by Esterline Angus. If Facit unit is not ordered with data system, only the mating plug (P4) which inserts into the interface output connector (J4) on the PD-2064 rear panel is furnished.

> NOTE: The cable itself may be ordered separately under part number 734C89.

B.3.2.4 PUTTING SYSTEM IN OPERATION

Set up operation of data system as follows:

a. Refer to "Installation" section of manual for instrument mounting and signal connection instructions.

b. Connect analog and/or digital signals to desired channel inputs and make appropriate entries of system constants program, channel constants program, and alarm setpoints program (if "Alarm" option is included) through the instrument keyboard as follows:

(1) Turn PD-2064 "on" by pressing power key (key lights up). Permit instrument to warm up for approximately 30 seconds.

(2) Press INPUT key to engage "Input Mode" of operation (display reads all L's); then, press HALT key and hold key down for one or two seconds. While key is held down, notice that L's in display rapidly flash on and off.

> NOTE: Pressing HALT key automatically resets the "Next Scan" time to zero and permits the operator to program the system without interruptions from scanning and outputting operations that might be initiated from a previously programmed "Next Scan" time.

(3) Perform following procedures that are given on left-hand, foldout sheet of "Operational Flow Diagram" (located in "Operation" section of manual).

(a) Program system constants per Section 2. DO NOT program the "Next Scan" time at this point.

(b) Select desired channel numbers per Section 3.1 and program channel constant codes for selected channels per Sections 3.3 and 3.4. See programming codes available as stipulated on instrument Data Sheet or as shown on "Side 2" of the programming guide.

(c) Program alarm setpoints (if this option is included) for selected channels per Section 3.5.

c. Interconnect PD-2064 to the Facit 4070 with cable assembly. Plug PD-2064 end of cable into connector J4 on rear panel, and plug other end of cable into appropriate connector on Facit unit. Refer to Facit instruction booklet for procedures governing operation of Facit unit.

d. Apply power to Facit after unit has been prepared for operation.

e. Initiate check of a channel scan and output cycle by performing steps under Section 1.3.1 on the operational flow diagram foldout sheet. Display blanks out during scan and output operations. Measured channel data is fed to output devices according to previous keyboard programming.

f. Data is outputted to device #1 first, and then to device #2 in the following sequence: frame header line, specified analog channels (per programmed I-O code), and specified optional digital channels (per programmed I-O code). The necessary carriage returns, line feeds, and record separators are also performed at the proper times throughout the output cycle. See output formatting in Figure B-8.1.

g. The total time required to output data is equal to the channel scan time plus the cumulative time that it takes for the output devices to receive and handle the data.

h. If "System Constant Printout" ("Program Printout") option is used, the system's programmed parameters may also be sent to each output device by following procedures under Sections 1.3.2 and 1.3.3 on the operational flow diagram foldout sheet. The system programming is outputted in duplicate -- first to device #1, and then to device #2. See output formatting of system's program as given in Figure B-8.2.

i. After output check has been made, reprogram desired "Next Scan" time with NEXT SCAN key by following procedures under Section 2 on the operational flow diagram foldout sheet.

j. If "Auto" mode of operating system is desired, press AUTO key.

NOTE: For further operational aspects of PD-2064, refer to "Operation" section of manual.

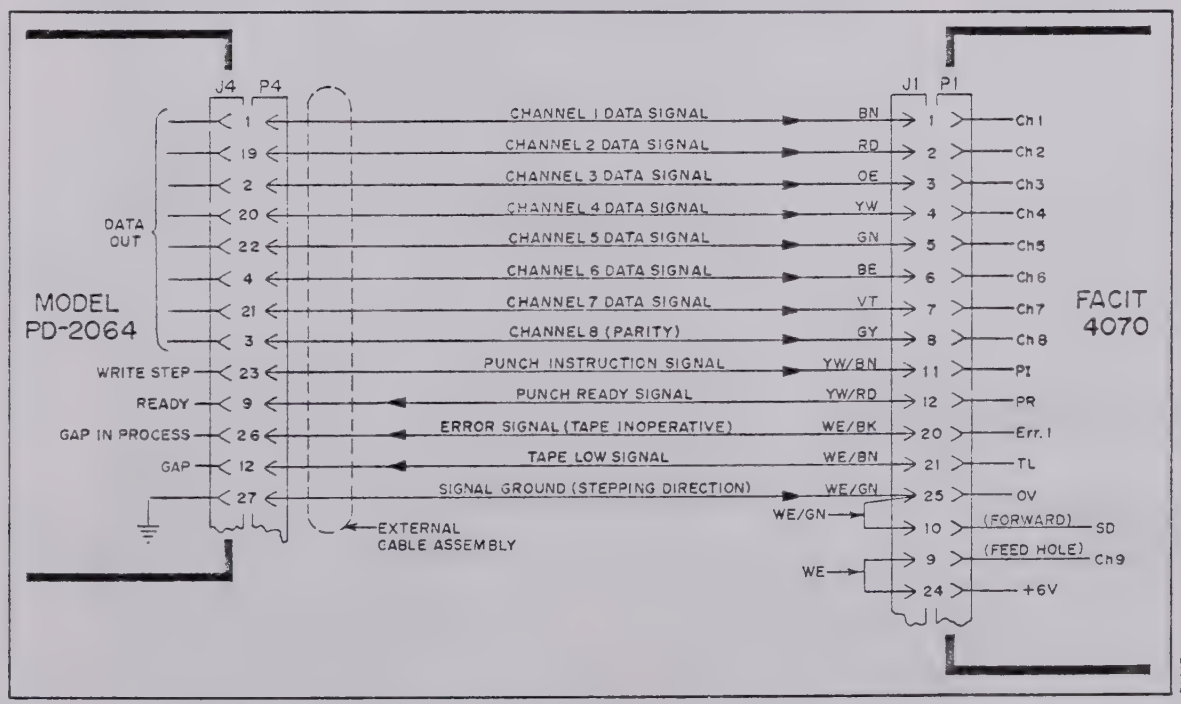


Figure B-8. Interconnection Diagram for Facit Interface Option.

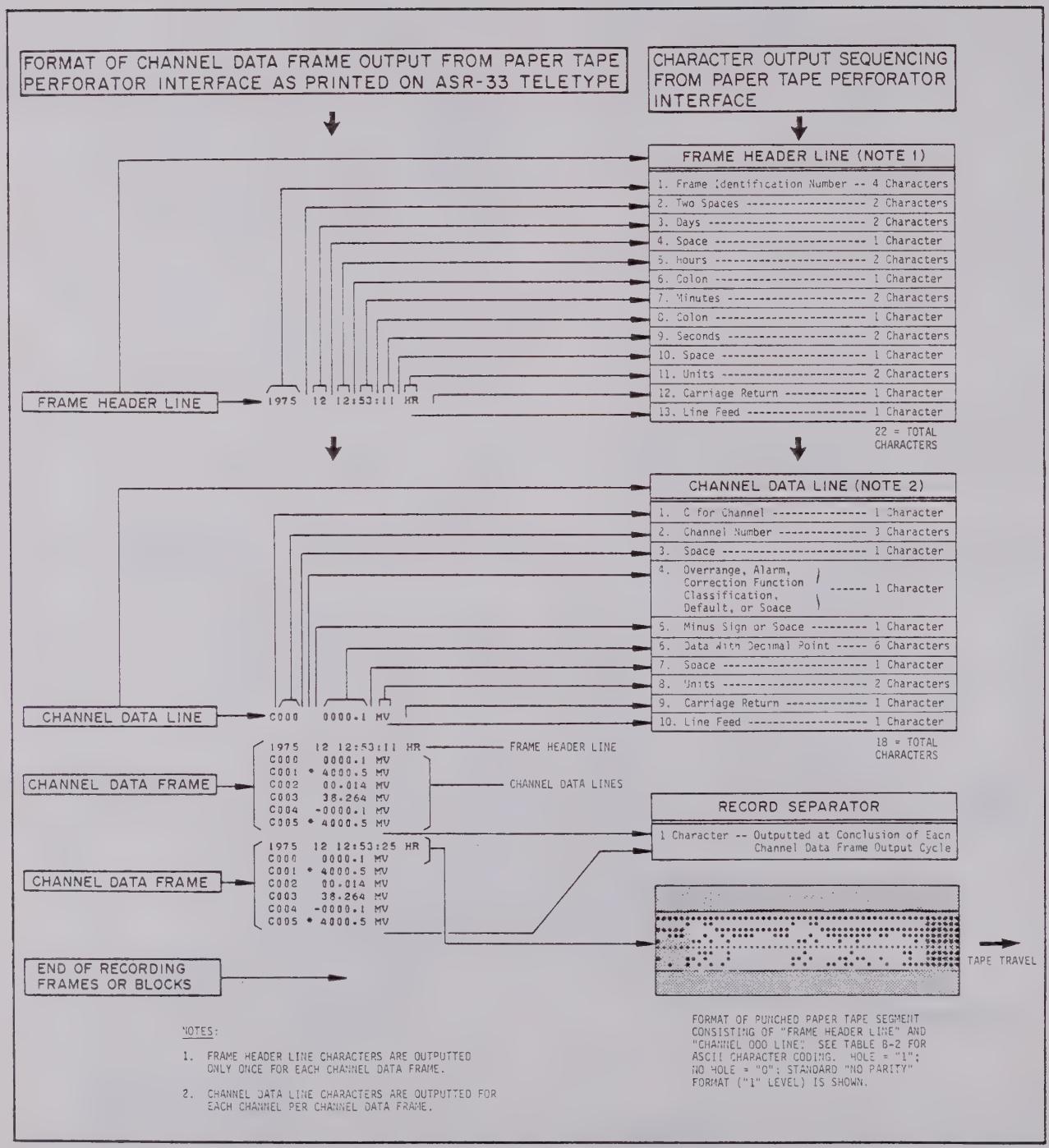

FORMAT OF CHANNEL DATA FRAME OUTPUT FROM PAPER TAPE PERFORATOR INTERFACE AS PRINTED ON ASR-33 TELETYPE
CHARACTER OUTPUT SEQUENCING FROM PAPER TAPE PERFORATOR INTERFACE
FRAME HEADER LINE (NOTE 1)
1. Frame Identification Number -- 4 Characters
2. Two Spaces -- 2 Characters
3. Days -- 2 Characters
4. Space -- 1 Character
5. Hours -- 2 Characters
6. Colon -- 1 Character
7. Minutes -- 2 Characters
8. Colon -- 1 Character
9. Seconds -- 2 Characters
10. Space -- 1 Character
11. Units -- 2 Characters
12. Carriage Return -- 1 Character
13. Line Feed -- 1 Character
22 = TOTAL CHARACTERS
FRAME HEADER LINE
1975 12 12:53:11 HR
CHANNEL DATA LINE (NOTE 2)
1. C for Channel -- 1 Character
2. Channel Number -- 3 Characters
3. Space -- 1 Character
4. Overrange, Alarm, Correction Function Classification, Default, or Space -- 1 Character
5. Minus Sign or Space -- 1 Character
6. Data With Decimal Point -- 6 Characters
7. Space -- 1 Character
8. Units -- 2 Characters
9. Carriage Return -- 1 Character
10. Line Feed -- 1 Character
18 = TOTAL CHARACTERS
CHANNEL DATA LINE
C000 0000.1 MV
CHANNEL DATA FRAME
1975 12 12:53:11 HR
C000 0000.1 MV
C001 * 4000.5 MV
C002 00.014 MV
C003 38.264 MV
C004 -0000.1 MV
C005 * 4000.5 MV
FRAME HEADER LINE
CHANNEL DATA LINES
RECORD SEPARATOR
1 Character -- Outputted at Conclusion of Each Channel Data Frame Output Cycle
CHANNEL DATA FRAME
1975 12 12:53:25 HR
C000 0000.1 MV
C001 * 4000.5 MV
C002 00.014 MV
C003 38.264 MV
C004 -0000.1 MV
C005 * 4000.5 MV
END OF RECORDING FRAMES OR BLOCKS
TAPE TRAVEL
NOTES:
1. FRAME HEADER LINE CHARACTERS ARE OUTPUTTED ONLY ONCE FOR EACH CHANNEL DATA FRAME.
2. CHANNEL DATA LINE CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PER CHANNEL DATA FRAME.
FORMAT OF PUNCHED PAPER TAPE SEGMENT CONSISTING OF "FRAME HEADER LINE" AND "CHANNEL 000 LINE". SEE TABLE B-2 FOR ASCII CHARACTER CODING. HOLE = "1"; NO HOLE = "0"; STANDARD "NO PARITY" FORMAT ("1" LEVEL) IS SHOWN.
P1425

Figure B-8.1. Output Formatting from Paper Tape Perforator Interface for Typical Channel Data Frames.

Table B-2. PD-2064 INTERFACE CODE OUTPUT FOR PERFORATED-PAPER TAPE RECORDING.

PD-2064 PRINTER DRUM CHARACTERS		CHARACTER, WORD, OR MESSAGE	ASCII CODE — BINARY CODE AS PUNCHED ON PAPER TAPE							CH. 8 (BIT 0) PARITY BINARY CODE AS PUNCHED ON PAPER TAPE †		
			CH. 1 (BIT 1)	CH. 2 (BIT 2)	CH. 3 (BIT 4)	CH. 4 (BIT 8)	CH. 5 (BIT A)	CH. 6 (BIT B)	CH. 7 (BIT C)	EVEN PARITY	ODD PARITY	NO PARITY
COLUMNS 3-20 CHARACTERS **	0	0	0	0	0	0	1	1	0	0	1	1
	1	1	1	0	0	0	1	1	0	1	0	1
	2	2	0	1	0	0	1	1	0	1	0	1
	3	3	1	1	0	0	1	1	0	0	1	1
	4	4	0	0	1	0	1	1	0	1	0	1
	5	5	1	0	1	0	1	1	0	0	1	1
	6	6	0	1	1	0	1	1	0	0	1	1
	7	7	1	1	1	0	1	1	0	1	0	1
	8	8	0	0	0	1	1	1	0	1	0	1
	9	9	1	0	0	1	1	1	0	0	1	1
	-	-	1	0	1	1	0	1	0	0	1	1
	.	.	0	1	1	1	0	1	0	0	1	1
	:	:	0	1	0	1	1	1	0	0	1	1
	Ch	C	1	1	0	0	0	0	1	1	0	1
	*	*	0	1	0	1	0	1	0	1	0	1
COLUMN 2 CHARACTERS**	M	M	1	0	1	1	0	0	1	0	1	1
	K	K	1	1	0	1	0	0	1	0	1	1
	○	D	0	0	1	0	0	0	1	0	1	1
	L	L	0	0	1	1	0	0	1	1	0	1
	F	F	0	1	1	0	0	0	1	1	0	1
	R	R	0	1	0	0	1	0	1	1	0	1
	I	I	1	0	0	1	0	0	1	1	0	1
	A	A	1	0	0	0	0	0	1	0	1	1
	H	H	0	0	0	1	0	0	1	0	1	1
	W	W	1	1	1	0	1	0	1	1	0	1
	V	V	0	1	1	0	1	0	1	0	1	1
	P	P	0	0	0	0	1	0	1	0	1	1
	Gm	G	1	1	1	0	0	0	1	0	1	1
	Kg	K	1	1	0	1	0	0	1	0	1	1
	Km	K	1	1	0	1	0	0	1	0	1	1
	No Character (Column Space)	Word Separator (Space)	0	0	0	0	0	1	0	1	0	1
COLUMN 1 CHARACTERS **	V	V	0	1	1	0	1	0	1	0	1	1
	A	A	1	0	0	0	0	0	1	0	1	1
	W	W	1	1	1	0	1	0	1	1	0	1
	Hz	H	0	0	0	1	0	0	1	0	1	1
	Ω	O	1	1	1	1	0	0	1	1	0	1
	F	F	0	1	1	0	0	0	1	1	0	1
	C	C	1	1	0	0	0	0	1	1	0	1
	/M	M	1	0	1	1	0	0	1	0	1	1
	/S	S	1	1	0	0	1	0	1	0	1	1
	/H	H	0	0	0	1	0	0	1	0	1	1
	Va	V	0	1	1	0	1	0	1	0	1	1
	Vr	V	0	1	1	0	1	0	1	0	1	1
	B	B	0	1	0	0	0	0	1	0	1	1
	R	R	0	1	0	0	1	0	1	1	0	1
	SI	I	1	0	0	1	0	0	1	1	0	1
	No Character (Column Space)	Word Separator (Space)	0	0	0	0	0	1	0	1	0	1
SPECIAL WORD BITS OF INSTRUCTION	No Characters on Drum	Carriage Return	1	0	1	1	0	0	0	1	0	1
		Line Feed	0	1	0	1	0	0	0	0	1	1
		Record Separator	0	1	1	1	1	0	0	0	1	1

NOTES:

** Refer to Figure B-1 for Printer Drum Pattern.

† Parity Bit is Generated by PD-2064 Interface Option by Order. Unless Otherwise Specified, "No Parity" will be Supplied.

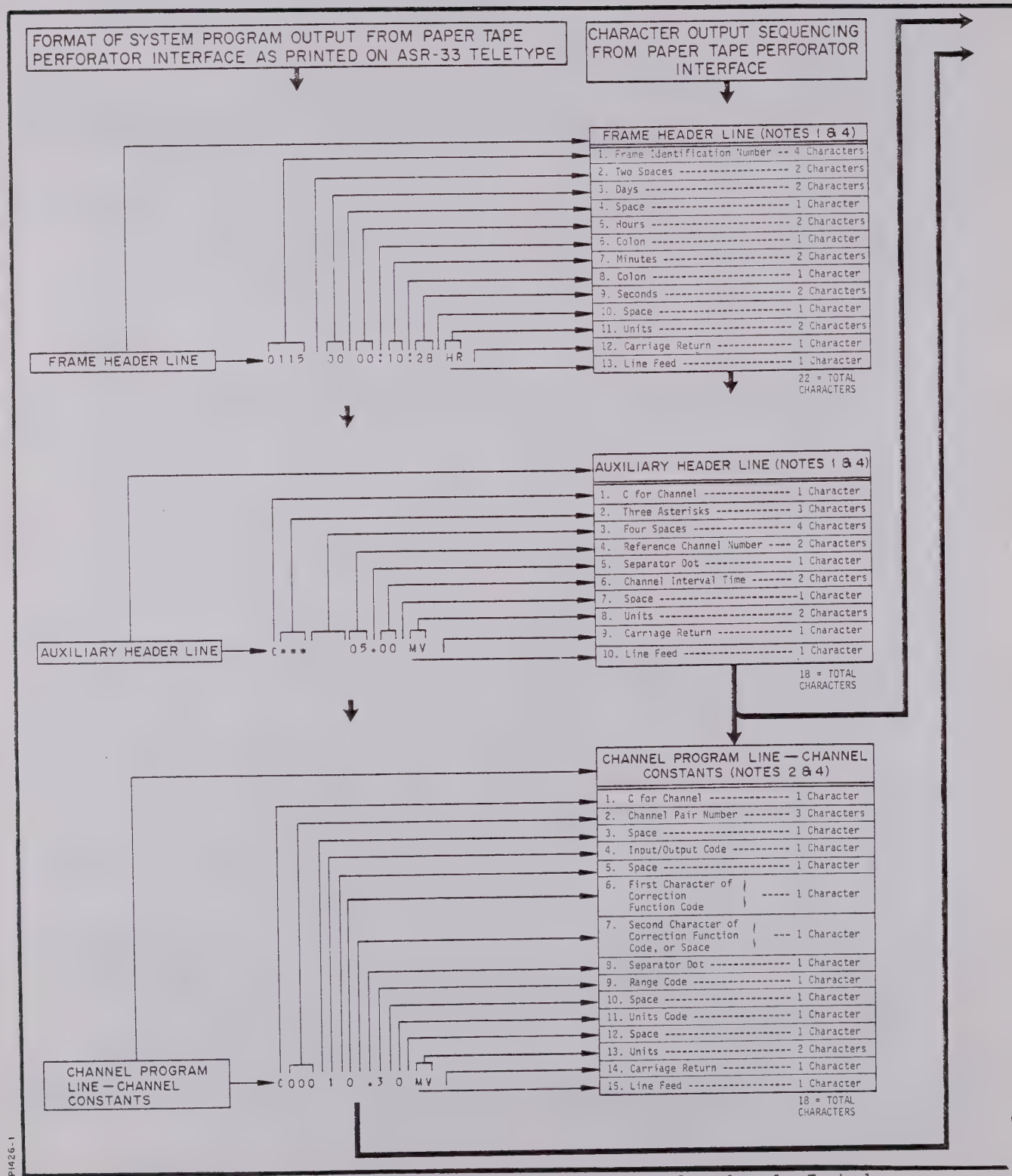

FORMAT OF SYSTEM PROGRAM OUTPUT FROM PAPER TAPE PERFORATOR INTERFACE AS PRINTED ON ASR-33 TELETYPE
CHARACTER OUTPUT SEQUENCING FROM PAPER TAPE PERFORATOR INTERFACE
FRAME HEADER LINE (NOTES 1 & 4)
1. Frame Identification Number -- 4 Characters
2. Two Spaces ---------- 2 Characters
3. Days ---------- 2 Characters
4. Space ---------- 1 Character
5. Hours ---------- 2 Characters
6. Colon ---------- 1 Character
7. Minutes ---------- 2 Characters
8. Colon ---------- 1 Character
9. Seconds ---------- 2 Characters
10. Space ---------- 1 Character
11. Units ---------- 2 Characters
12. Carriage Return ---------- 1 Character
13. Line Feed ---------- 1 Character
22 = TOTAL CHARACTERS
FRAME HEADER LINE
0115 00 00:10:28 HR
AUXILIARY HEADER LINE (NOTES 1 & 4)
1. C for Channel ---------- 1 Character
2. Three Asterisks ---------- 3 Characters
3. Four Spaces ---------- 4 Characters
4. Reference Channel Number ---- 2 Characters
5. Separator Dot ---------- 1 Character
6. Channel Interval Time ------- 2 Characters
7. Space ---------- 1 Character
8. Units ---------- 2 Characters
9. Carriage Return ---------- 1 Character
10. Line Feed ---------- 1 Character
18 = TOTAL CHARACTERS
AUXILIARY HEADER LINE
C*** 05.00 MV
CHANNEL PROGRAM LINE — CHANNEL CONSTANTS (NOTES 2 & 4)
1. C for Channel ---------- 1 Character
2. Channel Pair Number -------- 3 Characters
3. Space ---------- 1 Character
4. Input/Output Code ---------- 1 Character
5. Space ---------- 1 Character
6. First Character of Correction Function Code ----- 1 Character
7. Second Character of Correction Function Code, or Space --- 1 Character
8. Separator Dot ---------- 1 Character
9. Range Code ---------- 1 Character
10. Space ---------- 1 Character
11. Units Code ---------- 1 Character
12. Space ---------- 1 Character
13. Units ---------- 2 Characters
14. Carriage Return ---------- 1 Character
15. Line Feed ---------- 1 Character
18 = TOTAL CHARACTERS
CHANNEL PROGRAM LINE — CHANNEL CONSTANTS
C000 1 0 .3 0 MV
P1426-1

Figure B-8.2. Output Formatting from Paper Tape Perforator Interface for Typical Channel Program Frames (Sheet 1).

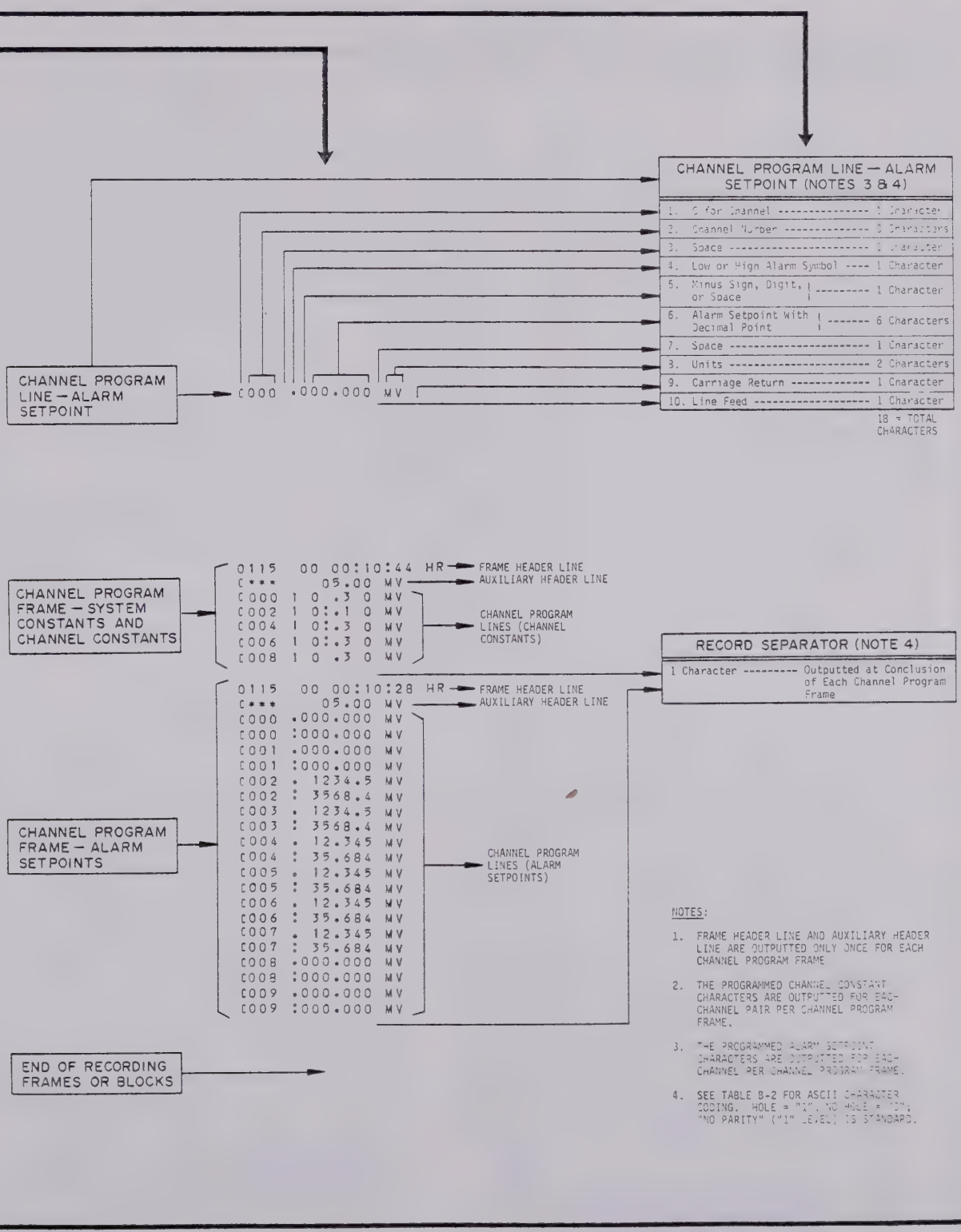
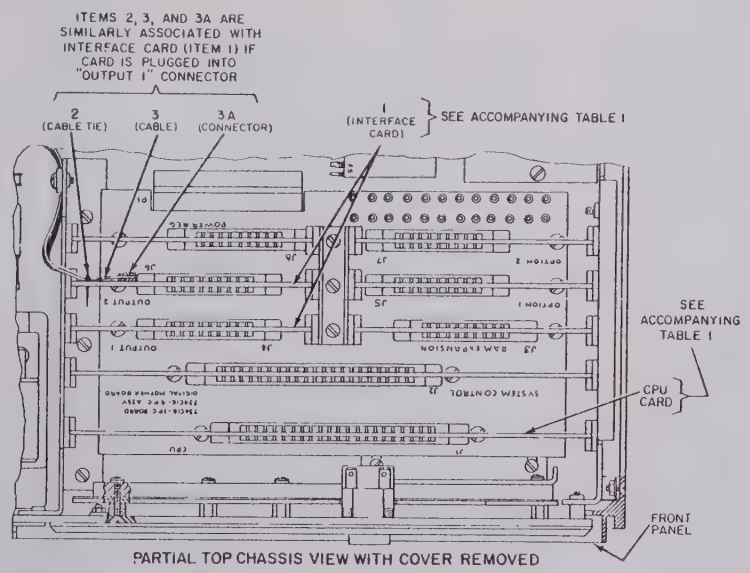

CHANNEL PROGRAM LINE — ALARM SETPOINT (NOTES 3 & 4)
1. C for Channel ---------- 1 Character
2. Channel Number ---------- 3 Characters
3. Space ---------- 1 Character
4. Low or High Alarm Symbol ---- 1 Character
5. Minus Sign, Digit, or Space ---------- 1 Character
6. Alarm Setpoint With Decimal Point ------- 6 Characters
7. Space ---------- 1 Character
8. Units ---------- 2 Characters
9. Carriage Return ---------- 1 Character
10. Line Feed ---------- 1 Character
18 = TOTAL CHARACTERS
CHANNEL PROGRAM LINE — ALARM SETPOINT
C000 .000.000 MV
CHANNEL PROGRAM FRAME — SYSTEM CONSTANTS AND CHANNEL CONSTANTS
0115 00 00:10:44 HR
C*** 05.00 MV
C000 1 0 .3 0 MV
C002 1 0:.1 0 MV
C004 1 0:.3 0 MV
C006 1 0:.3 0 MV
C008 1 0 .3 0 MV
FRAME HEADER LINE
AUXILIARY HEADER LINE
CHANNEL PROGRAM LINES (CHANNEL CONSTANTS)
RECORD SEPARATOR (NOTE 4)
1 Character --------- Outputted at Conclusion of Each Channel Program Frame
CHANNEL PROGRAM FRAME — ALARM SETPOINTS
0115 00 00:10:28 HR
C*** 05.00 MV
C000 .000.000 MV
C000 :000.000 MV
C001 .000.000 MV
C001 :000.000 MV
C002 . 1234.5 MV
C002 : 3568.4 MV
C003 . 1234.5 MV
C003 : 3568.4 MV
C004 . 12.345 MV
C004 : 35.684 MV
C005 . 12.345 MV
C005 : 35.684 MV
C006 . 12.345 MV
C006 : 35.684 MV
C007 . 12.345 MV
C007 : 35.684 MV
C008 .000.000 MV
C008 :000.000 MV
C009 .000.000 MV
C009 :000.000 MV
FRAME HEADER LINE
AUXILIARY HEADER LINE
CHANNEL PROGRAM LINES (ALARM SETPOINTS)
END OF RECORDING FRAMES OR BLOCKS
NOTES:
1. FRAME HEADER LINE AND AUXILIARY HEADER LINE ARE OUTPUTTED ONLY ONCE FOR EACH CHANNEL PROGRAM FRAME
2. THE PROGRAMMED CHANNEL CONSTANT CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PAIR PER CHANNEL PROGRAM FRAME.
3. THE PROGRAMMED ALARM SETPOINT CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PER CHANNEL PROGRAM FRAME.
4. SEE TABLE B-2 FOR ASCII CHARACTER CODING. HOLE = "1", NO HOLE = "0"; "NO PARITY" ("1" LEVEL) IS STANDARD.
P1426-2

Figure B-8.2. Output Formatting from Paper Tape Perforator Interface for Typical Channel Program Frames (Sheet 2).


ITEMS 2, 3, AND 3A ARE SIMILARLY ASSOCIATED WITH INTERFACE CARD (ITEM 1) IF CARD IS PLUGGED INTO "OUTPUT 1" CONNECTOR
2 (CABLE TIE)
3 (CABLE)
3A (CONNECTOR)
1 (INTERFACE CARD)
SEE ACCOMPANYING TABLE 1
SEE ACCOMPANYING TABLE 1
CPU CARD
FRONT PANEL
PARTIAL TOP CHASSIS VIEW WITH COVER REMOVED

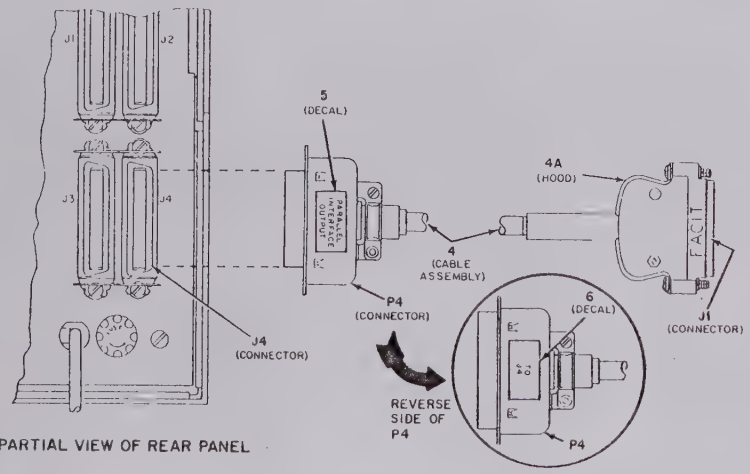


TABLE 1. COMPONENT LOCATIONS.

Component	Plug-In Location	
	For Output Device #1:	For Output Device #2:
Interface Control ROM	ROM 5 Position on CPU Card*	ROM 6 Position on CPU Card*
Interface PC Card	OUTPUT 1†	OUTPUT 2†

*Output Interface ROMs are Specially Programmed for Their Particular Output Device. Therefore, ROMs are not Interchangeable Unless Both Output Devices are the Same. Also, See Figure 1-3 in Section 1 of Manual.

†Plug-In Locations ("OUTPUT 1" and "OUTPUT 2") of the Output Interface Card Correspond With the Output Device Control ROMs.

Example: If ROM 5 Position is Used, Appropriate Interface Card for Output Device #1 Plugs Into "OUTPUT 1" Connector. If ROM 6 Position is Used, Appropriate Interface Card for Output Device #2 Plugs Into "OUTPUT 2" Connector. If Both ROM 5 and ROM 6 Positions are Used, Appropriate Interface Cards for Output Devices #1 and #2 Plug Into "OUTPUT 1" and "OUTPUT 2" Connectors, Respectively.

TABLE 2. PARTS LIST.

Item No.	Part No.	Description	Qty.
ROM 5 or ROM 6¶	Δ	ROM, Paper Tape Format and Driver	1
1	734C40-4	PC Card Assy., Parallel Interface	1
2	16755973-002	.Strap, Cable Tie-Down	1
3	734C62	.Cable Assy., Interface Card (28 In.)	1
3A	KPC-52	..Connector, PC Card Cable (34 Pin)	1
J4	KBR3-40360	..Connector, Rear Panel Cable (36 Pin)	1
4	734C89	Cable Assy., External Output (8 Ft.)	1
4A	KMC-36	.Hood for Connector, Facit	1
P4	91500-2	.Connector, Model PD-2064 (36 Pin)	1
J1	KMC-35	.Connector, Facit (25 Pin)	1
5	734B48-9	.Decal, Connector ("Parallel Interface Output")	1
6	734A56-4	Decal, Connector ("To J4")	1

ΔSee Part No. Stamped or Written on Underside of ROM Body.
¶For ROM Location, Refer to Figure 1-3 in Section 1 of Manual.

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Figure B-8.3. Location of Components and Parts Listing for Paper Tape Perforator Interface Option.

B.3.3 MAGNETIC TAPE RECORDERS

B.3.3.1 MAG TAPE SYSTEM SPECIFICATIONS

7-TRACK, KENNEDY MODEL 1600/5:

Mode: "Write only" standard.

Character Writing Rate: 275 characters/sec. (approximately).

Character Density: 556 characters/inch (22 characters/mm).

Reel Size: 8½" (216mm).

Tape Length: 1200' (366 meters).

Size: W = 19" (483mm); H = 12½" (318mm); D = 10" (254mm).

Weight: 40 pounds (18 kg).

AC Power: 115 volts (±10%), 50/60 Hz is standard. Other AC power requirements available upon order.

7-TRACK, KENNEDY MODEL 1610/5 (Same specifications as Model 1600/5 with following exceptions):

Reel Size: 10 ½" (267mm).

Tape Length: 2400' (732 meters).

Size: W = 19" (483mm); H = 24 ½" (622mm); D = 10" (254mm).

Weight: 70 pounds (32 kg.).

9-TRACK, KENNEDY MODEL 1600/360 (Same specifications as Model 1600/5 with following exception):

Character Density: 800 characters/inch (32 characters/mm).

9 TRACK, KENNEDY MODEL 1610/360 (Same specifications as Model 1610/5 with following exception):

Character Density: 800 characters/inch (32 characters/mm).

B.3.3.2 GENERAL

a. The reel-to-reel magnetic tape recorder is recommended in either 7-track (BCDIC) or 9-track (EBCDIC) configurations when it is desired to record large quantities of data from the PD-2064. Choice of 7- or 9- track is dictated by the computer input chosen for data reduction.

b. The primary advantage of a magnetic tape recording is recording speed coupled with high density storage. The disadvantages are vulnerability to dirty environmental conditions, particularly dust, which can cause errors and data loss. Temperature and humidity changes can also cause tape drive problems; and finally, it is not visually apparent to the operator that data is actually being placed on the tape, or that the data is accurate.

c. The preferred recording medium is the "IBM compatible" ½-inch (12.7mm) wide magnetic tape. The PD-2064 magnetic tape interface is specifically designed for incremental recorders that record one character at a time (nine bits for 9-track, seven bits for 7-track).

d. The interface provides character coding that is used to describe the basic characters found on the print drum of the standard Seiko

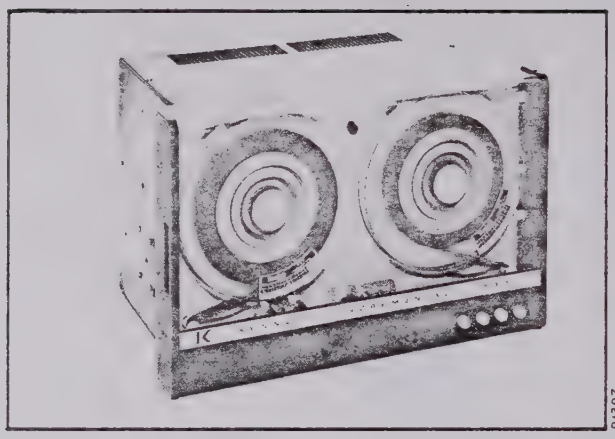


Figure B-9. Kennedy Models 1600/5 and 1600/360.

printer output device option (see Figure B-1). Each character recorded on the magnetic tape describes a single printer character--such as a digit, letter, punctuation mark, space, or an appropriate housekeeping character. As a result, a 16-character data line on the PD-2064 records 16 characters on the magnetic tape.

e. Data blocks on the tape correspond to data frames of the PD-2064. For example, a complete scan is made through the total number of channels being monitored, and a basic 16-character block is recorded on the magnetic tape for each line of data. Then an inter-record gap is inserted onto the tape at the end of the scanned data. At the end of the tape, a file gap may be inserted manually. The tape recorders themselves generate vertical and horizontal parity bits.

f. A special option permits magnetic recording at one rate (i.e., one scan/min.) and record data on another output device at another rate (i.e., one scan/hr.). This permits recording large amounts of data on tape with periodic outputting on printer for spot checks or inspection.

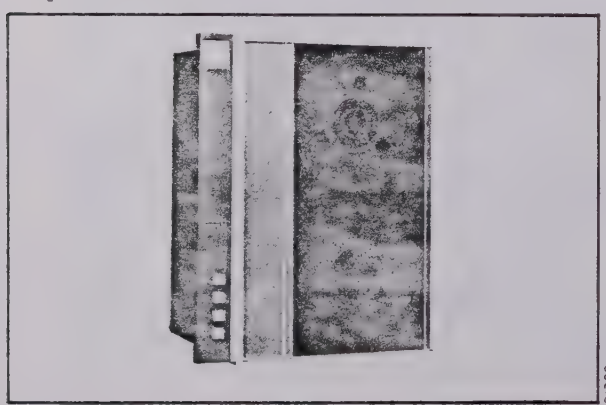


Figure B-10. Kennedy Models 1610/5 and 1610/360.

B.3.3.3 INTERFACE CONFIGURATION

a. The magnetic tape interface converts the acquired measured data and the programmed parameters of the data system into coded output signals which can be recorded on either a 7-track or 9-track Kennedy magnetic tape recorder. For 7-track recorders, the output of the interface is formatted into a parallel, 6-bit, IBM compatible, Binary Coded Decimal Interchange Code (BCDIC). For 9-track recorders, the output is formatted into a parallel, 8-bit, IBM compatible, Extended Binary Coded Decimal Interchange Code (EBCDIC).

b. The output codes generated by the interface are formatted into six data information tracks for 7-track recorders and eight data information tracks for 9-track recorders. The seventh and ninth information tracks for 7- and 9-track recorders, respectively, consist of a vertical parity bit code which is internally generated by the tape recorder.

c. Vertical parity selection (either "odd" or "even") is made by insertion ("odd" parity) or omission ("even" parity) of a jumper wire between pins 11 and 13 on the external output cable connector J1 (see Figure B-10.1).

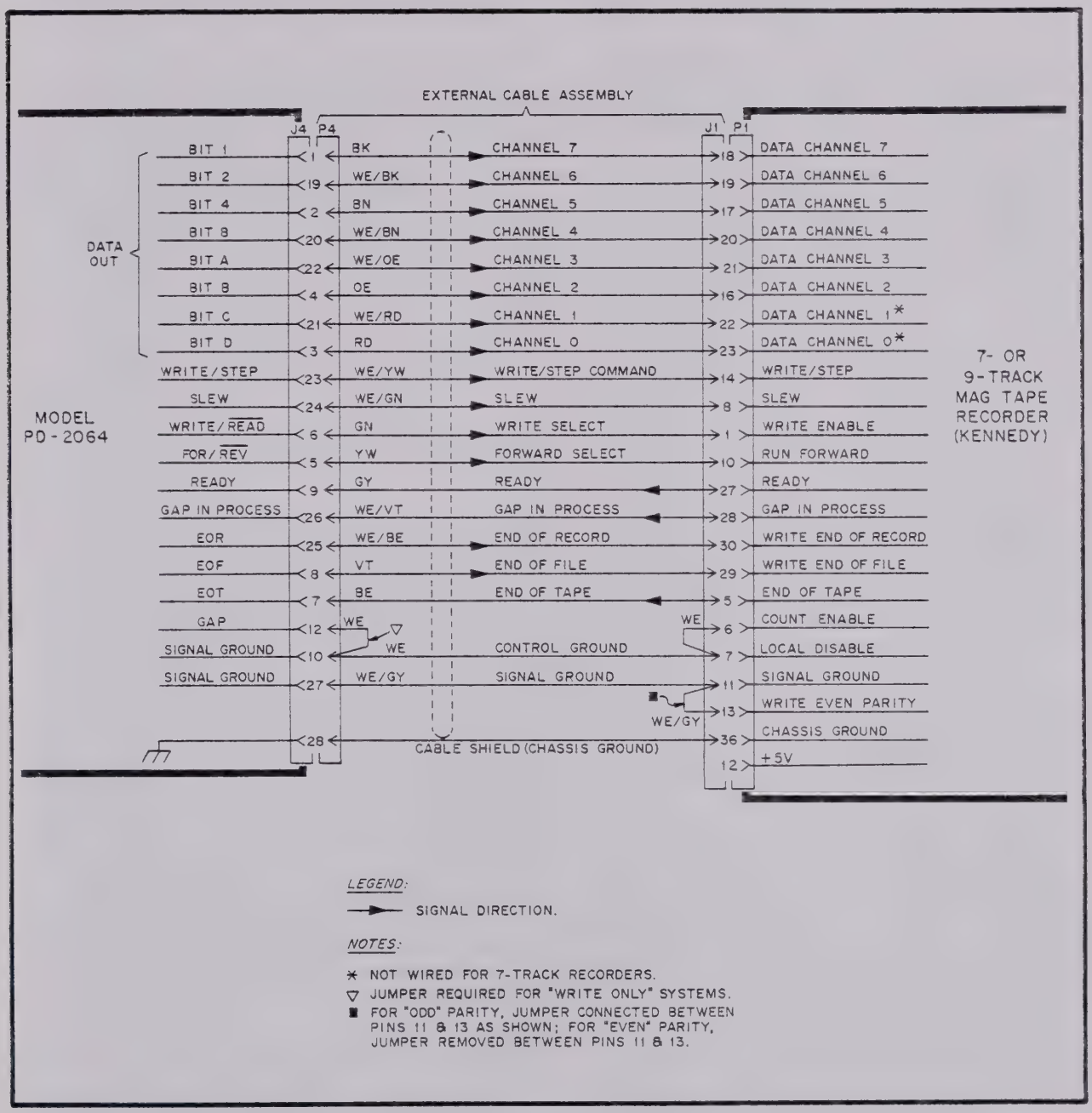
d. See character output coding in Table B-3. Also, see signal interconnections between Model PD-2064 and mag tape recorder as shown in Figure B-10.1.

e. Components added to the Model PD-2064 data system for this option include the following (refer to Figure B-10.4 for locations):

(1) A pre-programmed ROM modular circuit (item ROM 5 or ROM 6) that plugs into the central processing unit (CPU) card. This customized integrated circuit contains stored instructions that automatically code and format data before it is outputted to the tape recorder.

(2) A "Parallel Interface" card (item 1) that plugs into the appropriate output connector (either "OUTPUT 1" or "OUTPUT 2") on the "Digital Mother Board". This card assembly conditions and sequences the output signals to match the input requirements of the tape recorder.

> NOTE: The plug-in location of the interface card corresponds with the plug-in location of the interface control ROM. Example: If recorder is designated as output device #1, the control ROM (Z6) plugs into ROM 5 position on the CPU card, and the interface card plugs into the "OUTPUT 1" connector on "Digital Mother Board". Likewise, if recorder is designated as output device #2, the control ROM (Z7) plugs into ROM 6 position on the CPU card, and the interface card plugs into the "OUTPUT 2" connector on "Digital Mother Board".



LEGEND:

→ SIGNAL DIRECTION.

NOTES:

* NOT WIRED FOR 7-TRACK RECORDERS.

▽ JUMPER REQUIRED FOR "WRITE ONLY" SYSTEMS.

■ FOR "ODD" PARITY, JUMPER CONNECTED BETWEEN PINS 11 & 13 AS SHOWN; FOR "EVEN" PARITY, JUMPER REMOVED BETWEEN PINS 11 & 13.

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Figure 8-10.1 Cable Interconnection Diagram for 7- and 9-Track Mag Tape Interface.

Table B-3. PD-2064 Interface Code Output Table for IBM Compatible Magnetic Tape Recording.

	INTERFACE OUTPUT CODES FOR MAG TAPE																	
	BCDIC (7-TRACK)								EBCDIC (9-TRACK)									
CHARACTER, WORD, OR MESSAGE (NOTE 4)	CH. 1 (PARITY BIT)¶		CH. 2 (BIT B)	CH. 3 (BIT A)	CH. 4 (BIT 8)	CH. 5 (BIT 4)	CH. 6 (BIT 2)	CH. 7 (BIT 1)	CH. 0 (BIT D)	CH. 1 (BIT C)	CH. 2 (BIT B)	CH. 3 (BIT A)	CH. 4 (BIT 8)	CH. 5 (BIT 4)	CH. 6 (BIT 2)	CH. 7 (BIT 1)	CH. 8 (PARITY BIT)¶	
	ODD	EVEN															ODD	EVEN
0	1	0	0	0	1	0	1	0	1	1	1	1	0	0	0	0	1	0
1	0	1	0	0	0	0	0	1	1	1	1	1	0	0	0	1	0	1
2	0	1	0	0	0	0	1	0	1	1	1	1	0	0	1	0	0	1
3	1	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1	1	0
4	0	1	0	0	0	1	0	0	1	1	1	1	0	1	0	0	0	1
5	1	0	0	0	0	1	0	1	1	1	1	1	0	1	0	1	1	0
6	1	0	0	0	0	1	1	0	1	1	1	1	0	1	1	0	1	0
7	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1
8	0	1	0	0	1	0	0	0	1	1	1	1	1	0	0	0	0	1
9	1	0	0	0	1	0	0	1	1	1	1	1	1	0	0	1	1	0
-	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0
.	0	1	1	1	1	0	1	1	0	1	0	0	1	0	1	1	1	0
:	0	1	0	0	1	1	0	1	0	1	1	1	1	0	1	0	0	1
#(Default)	0	1	0	0	1	0	1	1	0	1	1	1	1	0	1	1	1	0
*	0	1	1	0	1	1	0	0	0	1	0	1	1	1	0	0	1	0
Space	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1
M	1	0	1	0	0	1	0	0	1	1	0	1	0	1	0	0	1	0
P	1	0	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1	0
C	1	0	1	1	0	0	1	1	1	1	0	0	0	0	1	1	1	0
R	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	1	0	1
F	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	1	0
S	1	0	0	1	0	0	1	0	1	1	1	0	0	0	1	0	1	0
I	1	0	1	1	1	0	0	1	1	1	0	0	1	0	0	1	1	0
Z	0	1	0	1	1	0	0	1	1	1	1	0	1	0	0	1	0	1
H	0	1	1	1	1	0	0	0	1	1	0	0	1	0	0	0	0	1
V	0	1	0	1	0	1	0	1	1	1	1	0	0	1	0	1	0	1
A	0	1	1	1	0	0	0	1	1	1	0	0	0	0	0	1	0	1
B	0	1	1	1	0	0	1	0	1	1	0	0	0	0	1	0	0	1
D	0	1	1	1	0	1	0	0	1	1	0	0	0	1	0	0	0	1
E	1	0	1	1	0	1	0	1	1	1	0	0	0	1	0	1	1	0
G	0	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	0	1
J	1	0	1	0	0	0	0	1	1	1	0	1	0	0	0	1	1	0
K	1	0	1	0	0	0	1	0	1	1	0	1	0	0	1	0	1	0
L	0	1	1	0	0	0	1	1	1	1	0	1	0	0	1	1	0	1
N	0	1	1	0	0	1	0	1	1	1	0	1	0	1	0	1	0	1
O	0	1	1	0	0	1	1	0	1	1	0	1	0	1	1	0	0	1
Q	1	0	1	0	1	0	0	0	1	1	0	1	1	0	0	0	1	0
T	0	1	0	1	0	0	1	1	1	1	1	0	0	0	1	1	0	1
U	1	0	0	1	0	1	0	0	1	1	1	0	0	1	0	0	1	0
W	0	1	0	1	0	1	1	0	1	1	1	0	0	1	1	0	0	1
X	1	0	0	1	0	1	1	1	1	1	1	0	0	1	1	1	1	0
Y	1	0	0	1	1	0	0	0	1	1	1	0	1	0	0	0	1	0

NOTES 1 & 3

NOTES 2 & 3

NOTES:

1. CODES FOR THESE CHARACTERS ARE GENERATED BY THE STANDARD MAG TAPE INTERFACE PROGRAM.
2. CODES FOR THESE CHARACTERS ARE NOT GENERATED BY THE STANDARD MAG TAPE INTERFACE PROGRAM.
3. OPTIONAL MAG TAPE INTERFACE PROGRAMS ARE AVAILABLE. CONSULT FACTORY.
4. SPECIAL WORD BITS OF INSTRUCTION SUCH AS "END OF RECORD" (EOR) COMMAND AND "END OF FILE" (EOF) COMMAND ARE INPUT PULSES APPLIED TO THE RECORDER VIA THE INTERFACE.

¶ FOR PARITY BIT SELECTION, REFER TO WIRING AT PINS 11 AND 13 OF EXTERNAL CABLE ASSEMBLY CONNECTOR J1 SHOWN IN FIGURE B-10.1. PARITY BIT IS GENERATED BY TAPE RECORDER AND NOT BY THE INTERFACE.

(3) An internal output cable (item 3) that connects the output of the interface card to a connector (item J4) on the PD-2064 rear panel.

(4) An external output cable assembly (item 4) that interconnects the Model PD-2064 and the tape recorder (Figure B-10.1). This cable assembly is supplied with data system when recorder is furnished by Esterline Angus. If recorder is not ordered with data system, only the mating plug (P4) which inserts into the interface output connector (J4) on the PD-2064 rear panel is furnished.

NOTE: The cable itself may be ordered separately under part number 734C98.

B.3.3.4 PUTTING SYSTEM IN OPERATION

Set up operation of data system as follows:

a. Refer to "Installation" section of manual for instrument mounting and signal connection instructions.

b. Connect analog and/or digital signals to desired channel inputs and make appropriate entries of system constants program, channel constants program, and alarm setpoints program (if "Alarm" option is included) through the instrument keyboard as follows:

(1) Turn PD-2064 "on" by pressing power key (key lights up). Permit instrument to warm up for approximately 30 seconds.

(2) Press INPUT key to engage "Input Mode" of operation (display reads all L's); then, press HALT key and hold key down for one or two seconds. While key is held down, notice that L's in display rapidly flash on and off.

NOTE: Pressing HALT key automatically resets the "Next Scan" time to zero and permits the operator to program the system without interruptions from scanning and outputting operations that might be initiated from a previously programmed "Next Scan" time.

(3) Perform following procedures that are given on left-hand, foldout sheet of "Operational Flow Diagram" (located in "Operation" section of manual).

(a) Program system constants per Section 2. DO NOT program the "Next Scan" time at this point.

(b) Select desired channel numbers per Section 3.1 and program channel constant codes for selected channels per Section 3.3 and 3.4. See programming codes available as stipulated on instrument Data Sheet or as shown on "Side 2" of the programming guide.

(c) Program alarm setpoints (if this option is included) for selected channels per Section 3.5.

c. Interconnect PD-2064 to the tape recorder with cable assembly. Plug PD-2064 end of cable into connector J4 on rear panel, and plug other end of cable into appropriate connector on recorder. Refer to Kennedy instruction manual for procedures governing operation of recorder.

d. Apply power to recorder after unit has been prepared for operation.

e. Initiate check of a channel scan and output cycle by performing steps under Section 1.3.1 on the operational flow diagram foldout sheet. Display blanks out during scan and output operations. Measured channel data is fed to output devices according to previous keyboard programming.

f. Data is outputted to device #1 first, and then to device #2 in the following sequence: frame header line, specified analog channels (per programmed I-O code), and specified optional digital channels (per programmed I-O code). The necessary carriage returns, line feeds, end of record gaps, and end of file gaps are also performed at the proper times throughout the output cycles. See output formatting in Figure B-10.2.

g. The total time required to output data is equal to the channel scan time plus the cumulative time that it takes for the output devices to receive and handle the data.

h. If "System Constant Printout" ("Program Printout") option is used, the system's programmed parameters may also be sent to each output device by following procedures under Sections 1.3.2 and 1.3.3 on the operational flow diagram foldout sheet. The system programming is outputted in duplicate -- first to device #1, and then to device #2. See output formatting of system's program as given in Figure B-10.3.

i. After output check has been made, reprogram desired "Next Scan" time with NEXT SCAN key by following procedures under Section 2 on the operational flow diagram foldout sheet.

j. If "Auto" mode of operating system is desired, press AUTO key.

NOTE: For further operational aspects of PD-2064, refer to "Operation" section of manual.

(Intentionally Blank)

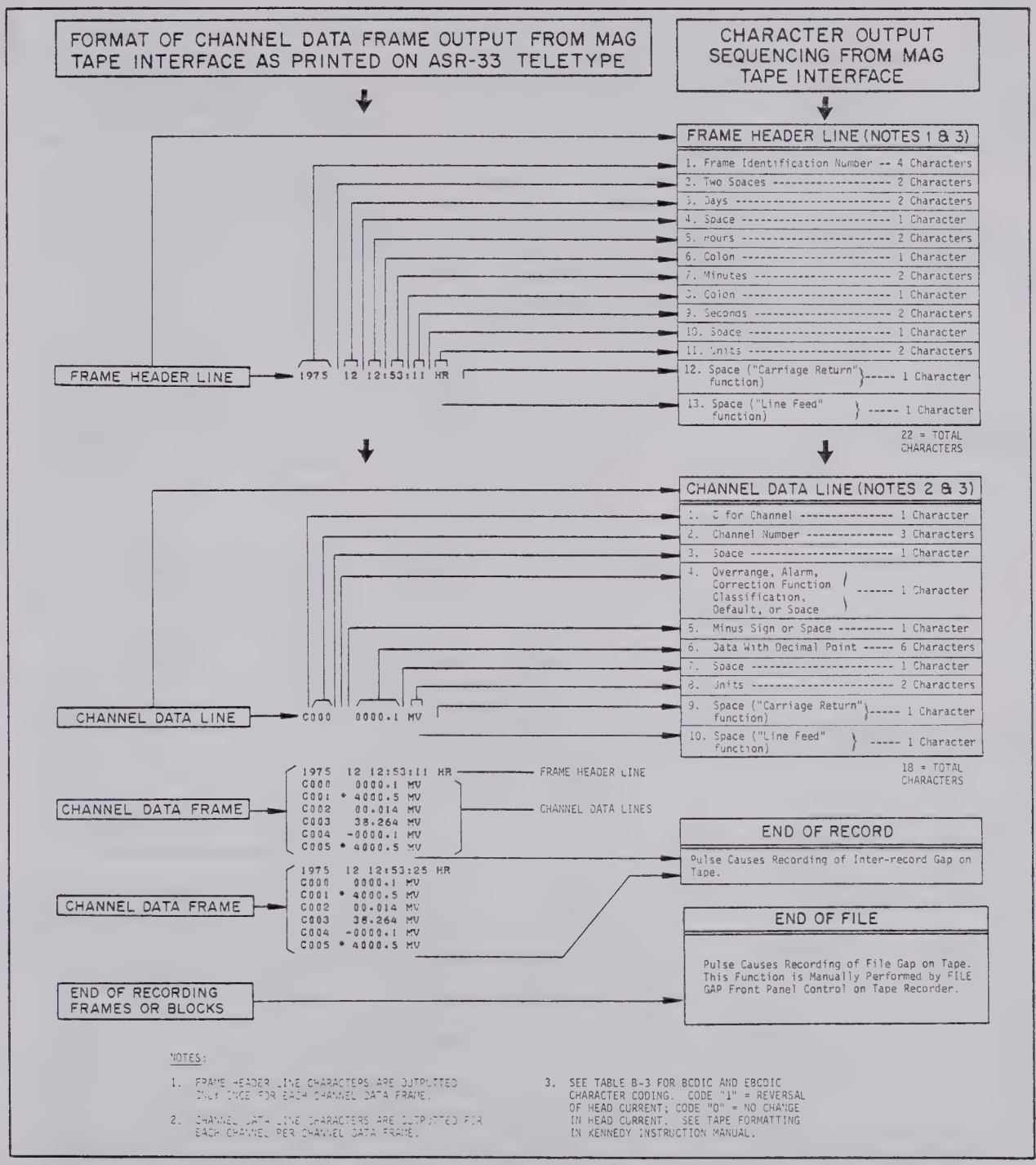

FORMAT OF CHANNEL DATA FRAME OUTPUT FROM MAG TAPE INTERFACE AS PRINTED ON ASR-33 TELETYPE
CHARACTER OUTPUT SEQUENCING FROM MAG TAPE INTERFACE
FRAME HEADER LINE (NOTES 1 & 3)
1. Frame Identification Number -- 4 Characters
2. Two Spaces ---------- 2 Characters
3. Days ---------- 2 Characters
4. Space ---------- 1 Character
5. Hours ---------- 2 Characters
6. Colon ---------- 1 Character
7. Minutes ---------- 2 Characters
8. Colon ---------- 1 Character
9. Seconds ---------- 2 Characters
10. Space ---------- 1 Character
11. Units ---------- 2 Characters
12. Space ("Carriage Return" function) ----- 1 Character
13. Space ("Line Feed" function) ----- 1 Character
22 = TOTAL CHARACTERS
FRAME HEADER LINE
1975 12 12:53:11 HR
CHANNEL DATA LINE (NOTES 2 & 3)
1. C for Channel ---------- 1 Character
2. Channel Number ---------- 3 Characters
3. Space ---------- 1 Character
4. Overrange, Alarm, Correction Function Classification, Default, or Space ------ 1 Character
5. Minus Sign or Space --------- 1 Character
6. Data With Decimal Point ----- 6 Characters
7. Space ---------- 1 Character
8. Units ---------- 2 Characters
9. Space ("Carriage Return" function) ----- 1 Character
10. Space ("Line Feed" function) ----- 1 Character
18 = TOTAL CHARACTERS
CHANNEL DATA LINE
C000 0000.1 MV
CHANNEL DATA FRAME
1975 12 12:53:11 HR
C000 0000.1 MV
C001 * 4000.5 MV
C002 00.014 MV
C003 38.264 MV
C004 -0000.1 MV
C005 * 4000.5 MV
FRAME HEADER LINE
CHANNEL DATA LINES
CHANNEL DATA FRAME
1975 12 12:53:25 HR
C000 0000.1 MV
C001 * 4000.5 MV
C002 00.014 MV
C003 38.264 MV
C004 -0000.1 MV
C005 * 4000.5 MV
END OF RECORD
Pulse Causes Recording of Inter-record Gap on Tape.
END OF FILE
Pulse Causes Recording of File Gap on Tape. This Function is Manually Performed by FILE GAP Front Panel Control on Tape Recorder.
END OF RECORDING FRAMES OR BLOCKS
NOTES:
1. FRAME HEADER LINE CHARACTERS ARE OUTPUTTED ONLY ONCE FOR EACH CHANNEL DATA FRAME.
2. CHANNEL DATA LINE CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PER CHANNEL DATA FRAME.
3. SEE TABLE B-3 FOR BCDIC AND EBCDIC CHARACTER CODING. CODE "1" = REVERSAL OF HEAD CURRENT; CODE "0" = NO CHANGE IN HEAD CURRENT. SEE TAPE FORMATTING IN KENNEDY INSTRUCTION MANUAL.
P1432

Figure B-10.2. Output Formatting from Mag Tape Interface for Typical Channel Data Frames.

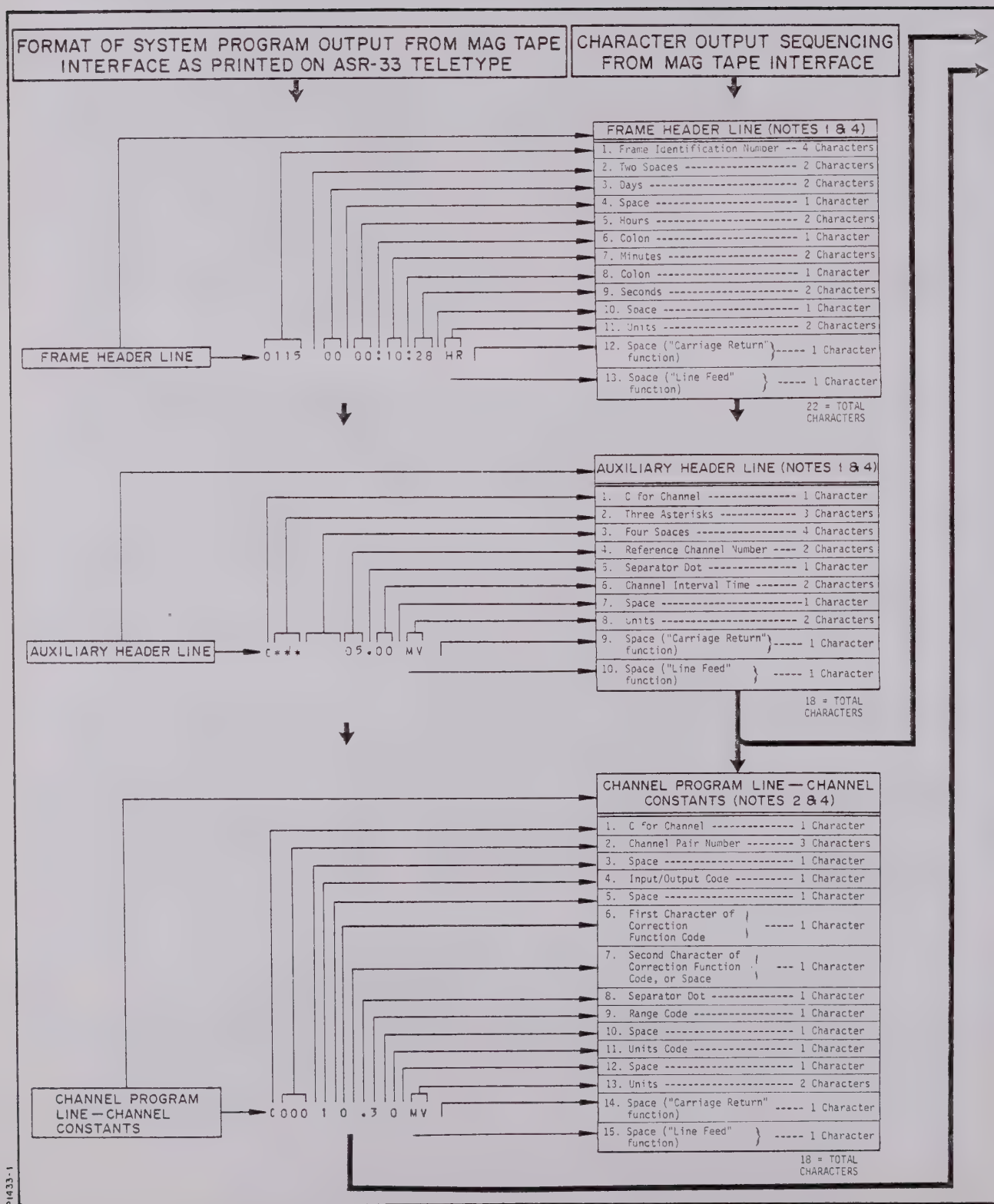

FORMAT OF SYSTEM PROGRAM OUTPUT FROM MAG TAPE INTERFACE AS PRINTED ON ASR-33 TELETYPE
CHARACTER OUTPUT SEQUENCING FROM MAG TAPE INTERFACE
FRAME HEADER LINE (NOTES 1 & 4)
1. Frame Identification Number -- 4 Characters
2. Two Spaces ---------- 2 Characters
3. Days ---------- 2 Characters
4. Space ---------- 1 Character
5. Hours ---------- 2 Characters
6. Colon ---------- 1 Character
7. Minutes ---------- 2 Characters
8. Colon ---------- 1 Character
9. Seconds ---------- 2 Characters
10. Space ---------- 1 Character
11. Units ---------- 2 Characters
12. Space ("Carriage Return" function) ----- 1 Character
13. Space ("Line Feed" function) ----- 1 Character
22 = TOTAL CHARACTERS
FRAME HEADER LINE
0115 00 00:10:28 HR
AUXILIARY HEADER LINE (NOTES 1 & 4)
1. C for Channel ---------- 1 Character
2. Three Asterisks ---------- 3 Characters
3. Four Spaces ---------- 4 Characters
4. Reference Channel Number ---- 2 Characters
5. Separator Dot ---------- 1 Character
6. Channel Interval Time -------- 2 Characters
7. Space ----------1 Character
8. Units ---------- 2 Characters
9. Space ("Carriage Return" function) ----- 1 Character
10. Space ("Line Feed" function) ----- 1 Character
18 = TOTAL CHARACTERS
AUXILIARY HEADER LINE
C*** 05.00 MV
CHANNEL PROGRAM LINE — CHANNEL CONSTANTS (NOTES 2 & 4)
1. C for Channel ---------- 1 Character
2. Channel Pair Number -------- 3 Characters
3. Space ---------- 1 Character
4. Input/Output Code ---------- 1 Character
5. Space ---------- 1 Character
6. First Character of Correction Function Code ----- 1 Character
7. Second Character of Correction Function Code, or Space --- 1 Character
8. Separator Dot ---------- 1 Character
9. Range Code ---------- 1 Character
10. Space ---------- 1 Character
11. Units Code ---------- 1 Character
12. Space ---------- 1 Character
13. Units ---------- 2 Characters
14. Space ("Carriage Return" function) ----- 1 Character
15. Space ("Line Feed" function) ----- 1 Character
18 = TOTAL CHARACTERS
CHANNEL PROGRAM LINE — CHANNEL CONSTANTS
C000 1 0 .3 0 MV
P1433-1

Figure B-10.3. Output Formatting from Mag Tape Interface for Typical Channel Program Frames (Sheet 1).

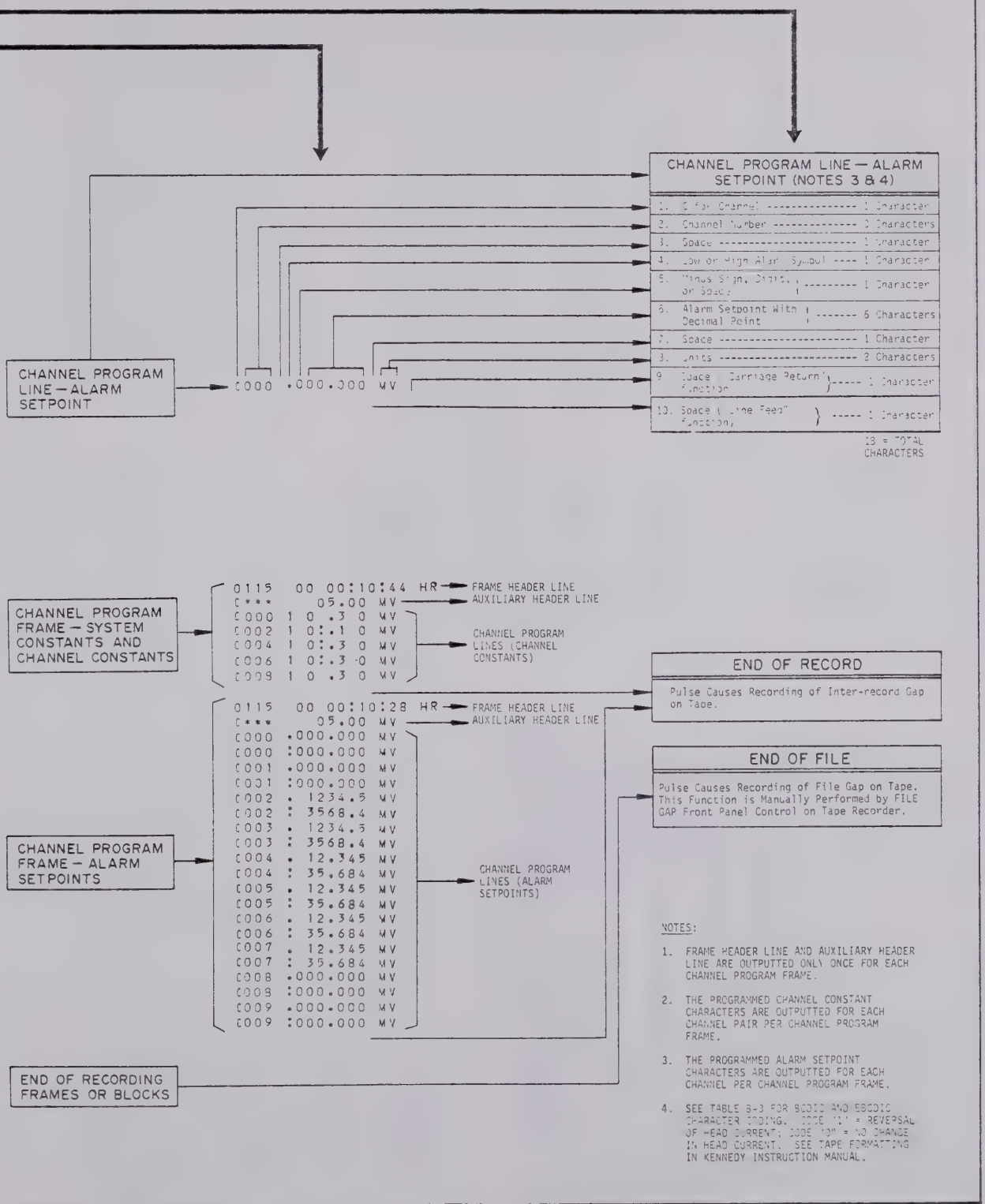
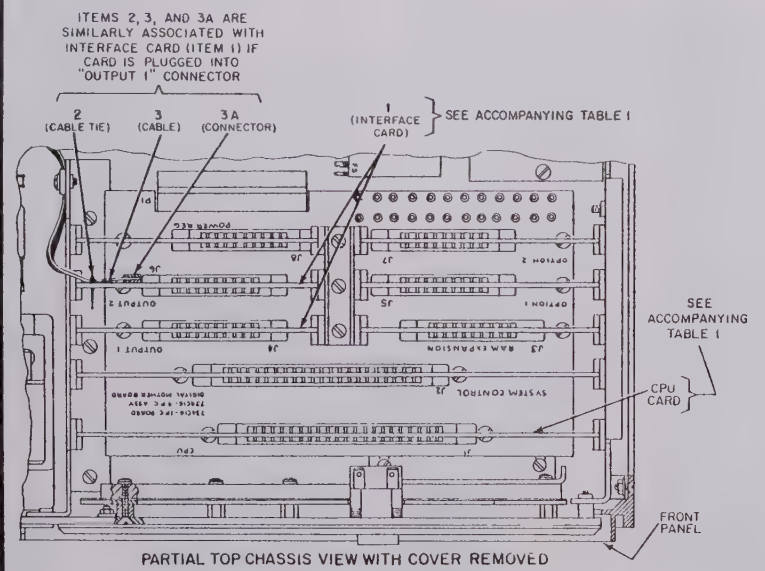
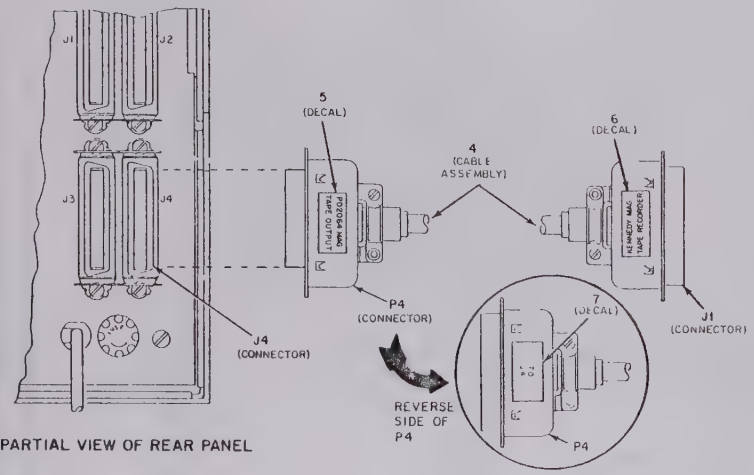

CHANNEL PROGRAM LINE — ALARM SETPOINT (NOTES 3 & 4)
1. C for Channel ---------- 1 Character
2. Channel Number ---------- 2 Characters
3. Space ---------- 1 Character
4. Low or High Alarm Symbol ---- 1 Character
5. "Minus Sign, Digit, or Space" ---------- 1 Character
6. Alarm Setpoint With Decimal Point ------- 6 Characters
7. Space ---------- 1 Character
8. Units ---------- 2 Characters
9. Space (Carriage Return Function) ----- 1 Character
10. Space (Line Feed Function) ----- 1 Character
19 = TOTAL CHARACTERS
CHANNEL PROGRAM LINE — ALARM SETPOINT
C000 .000.000 MV
CHANNEL PROGRAM FRAME — SYSTEM CONSTANTS AND CHANNEL CONSTANTS
0115 00 00:10:44 HR
FRAME HEADER LINE
C*** 05.00 MV
AUXILIARY HEADER LINE
C000 1 0 .3 0 MV
C002 1 0:.1 0 MV
C004 1 0:.3 0 MV
C006 1 0:.3 0 MV
C008 1 0 .3 0 MV
CHANNEL PROGRAM LINES (CHANNEL CONSTANTS)
END OF RECORD
Pulse Causes Recording of Inter-record Gap on Tape.
CHANNEL PROGRAM FRAME — ALARM SETPOINTS
0115 00 00:10:28 HR
FRAME HEADER LINE
C*** 05.00 MV
AUXILIARY HEADER LINE
C000 .000.000 MV
C000 :000.000 MV
C001 .000.000 MV
C001 :000.000 MV
C002 . 1234.5 MV
C002 : 3568.4 MV
C003 . 1234.5 MV
C003 : 3568.4 MV
C004 . 12.345 MV
C004 : 35.684 MV
C005 . 12.345 MV
C005 : 35.684 MV
C006 . 12.345 MV
C006 : 35.684 MV
C007 . 12.345 MV
C007 : 35.684 MV
C008 .000.000 MV
C008 :000.000 MV
C009 .000.000 MV
C009 :000.000 MV
CHANNEL PROGRAM LINES (ALARM SETPOINTS)
END OF FILE
Pulse Causes Recording of File Gap on Tape. This Function is Manually Performed by FILE GAP Front Panel Control on Tape Recorder.
END OF RECORDING FRAMES OR BLOCKS
NOTES:
1. FRAME HEADER LINE AND AUXILIARY HEADER LINE ARE OUTPUTTED ONLY ONCE FOR EACH CHANNEL PROGRAM FRAME.
2. THE PROGRAMMED CHANNEL CONSTANT CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PAIR PER CHANNEL PROGRAM FRAME.
3. THE PROGRAMMED ALARM SETPOINT CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PER CHANNEL PROGRAM FRAME.
4. SEE TABLE B-3 FOR BCDIC AND EBCDIC CHARACTER CODING. CODE "1" = REVERSAL OF HEAD CURRENT. CODE "0" = NO CHANGE IN HEAD CURRENT. SEE TAPE FORMATTING IN KENNEDY INSTRUCTION MANUAL.
P1433-2

Figure B-10.3. Output Formatting from Mag Tape Interface for Typical Channel Program Frames (Sheet 2).


ITEMS 2, 3, AND 3A ARE SIMILARLY ASSOCIATED WITH INTERFACE CARD (ITEM 1) IF CARD IS PLUGGED INTO "OUTPUT 1" CONNECTOR
2 (CABLE TIE)
3 (CABLE)
3A (CONNECTOR)
1 (INTERFACE CARD)
SEE ACCOMPANYING TABLE 1
SEE ACCOMPANYING TABLE 1
CPU CARD
FRONT PANEL

PARTIAL TOP CHASSIS VIEW WITH COVER REMOVED



PARTIAL VIEW OF REAR PANEL

TABLE 1. COMPONENT LOCATIONS.

Component	Plug-In Location	
	For Output Device #1:	For Output Device #2:
Interface Control ROM	ROM 5 Position on CPU Card*	ROM 6 Position on CPU Card*
Interface PC Card	OUTPUT 1†	OUTPUT 2†

*Output Interface ROMs are Specially Programmed for Their Particular Output Device. Therefore, ROMs are not Interchangeable Unless Both Output Devices are the Same. Also, See Figure 1-3 in Section 1 of Manual.

†Plug-In Locations ("OUTPUT 1" and "OUTPUT 2") of the Output Interface Card Correspond With the Output Device Control ROMs.

Example: If ROM 5 Position is Used, Appropriate Interface Card for Output Device #1 Plugs Into "OUTPUT 1" Connector. If ROM 6 Position is Used, Appropriate Interface Card for Output Device #2 Plugs Into "OUTPUT 2" Connector. If Both ROM 5 and ROM 6 Positions are Used, Appropriate Interface Cards for Output Devices #1 and #2 Plug Into "OUTPUT 1" and "OUTPUT 2" Connectors, Respectively.

TABLE 2. PARTS LIST.

Item No.	Part No.	Description	Qty.
ROM 5 or ROM 6¶	Δ	ROM, Mag Tape Format and Driver	1
1	734C40-4	PC Card Assy., Parallel Interface	1
2	16755973-002	.Strap, Cable Tie-Down	1
3	734C62	.Cable Assy., Interface Card (28 In.)	1
3A	KPC-52	..Connector, PC Card Cable (34 Pin)	1
J4	KBR3-40360	..Connector, Rear Panel Cable (36 Pin)	1
4	734C98	Cable Assy., External Output (8 Ft.)	1
P4	91500-2	.Connector, Model PD-2064 (36 Pin)	1
J1	91500-2	.Connector, Kennedy (36 Pin)	1
5	734B48-1	.Decal, Connector ("PD-2064 Mag Tape Output")	1
6	734B48-2	.Decal, Connector ("Kennedy Mag Tape Recorder")	1
7	734A56-4	Decal, Connector ("To J4")	1

ΔSee Part No. Stamped or Written on Underside of ROM Body.
¶For ROM Location, Refer to Figure 1-3 in Section 1 of Manual.

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Figure B-10.4. Location of Components and Parts Listing for Mag Tape Interface Option.

B.3.4 TELEPRINTER OR TERMINAL

B.3.4.1 PD-2064-TTY SYSTEM SPECIFICATIONS

Model: Teletype Model 3320/3JA; Includes pedestal base,page copy teleprinter, keyboard assembly, and paper tape perforator with chad box; Optional equipment includes modem couplers, printer disable kits, and other items.

Mode: "Write only" is standard;20 mA, 2 wire, half-duplex (one-way) operation is standard.

Character Writing Rate: 110 baud (10 characters/sec.) is standard; Faster output rates are available as an option (consult factory) from the PD-2064 for higher-speed output terminals.

Printed Record: Page format (see Figure B-12).

Output Code: USASCII(1968 version) 8-level code; no parity is standard (parity type is preprogrammed in the output interface control ROM).

B.3.4.2 GENERAL

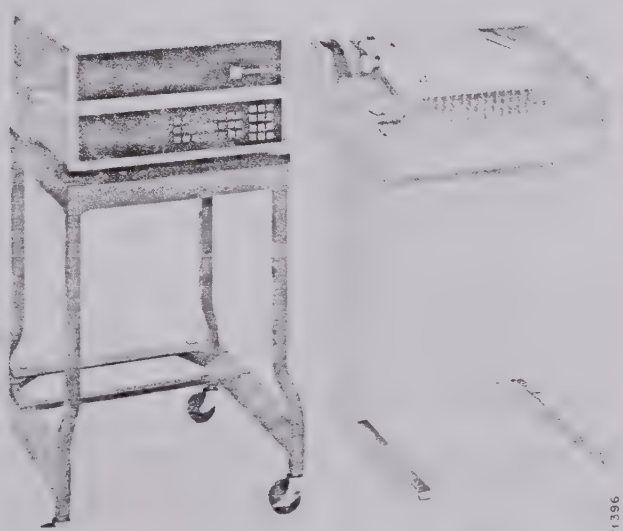
a. The teletype interface option converts the digital data acquired by the PD-2064 into a serial, 8-level, USASCII code. The data conversion code permits system compatibility with a standard Model ASR-33 Teletypewriter or any other device that is mutually compatible--such as other make teletypewriter terminals, tape perforators, CRT terminals, and computers. In using this code, each character or function is represented by "current on" and "current off" time intervals in the signal line communications between the PD-2064 unit and its peripherals.

b. In typical use, the PD-2064 data may be fed to the ASR-33 tape punch and stored for later transmission; or data may be outputted to a computer via a modem phone link while simultaneously being printed out in page format on the ASR-33.

c. Data from the PD-2064 is sent to the teletypewriter with supplementary housekeeping characters. A carriage return and line feed are inserted after each four channels of data so that page copy is produced. A typical teletype printout of a data frame and an alarm setpoints program is shown in Figure B-12. Note in Figure B-12 that printout is formatted for easy interpretation of the data. The frame header line, channel numbers, data, decimal points, and engineering units are readily identified.

d. The standard interface is for "write only" operation and is furnished with an interconnecting cable and a "write only" relay board for making necessary interconnections between the PD-2064 and the ASR-33 typewriter.

e. On-off control of the teletypewriter motor follows the operational mode of the PD-2064. For example, when PD-2064 powers down between channel frame scans in the "Auto" mode, AC power to the teletypewriter motor is switched off. When a scan takes place, PD-2064 powers back up and causes power to be switched back on to the teletypewriter motor. When PD-2064 is in the "Input" mode, power to the motor remains switched on.



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Figure B-11. PD-2064-TTY System Shown With Model ASR-33 Output Device.

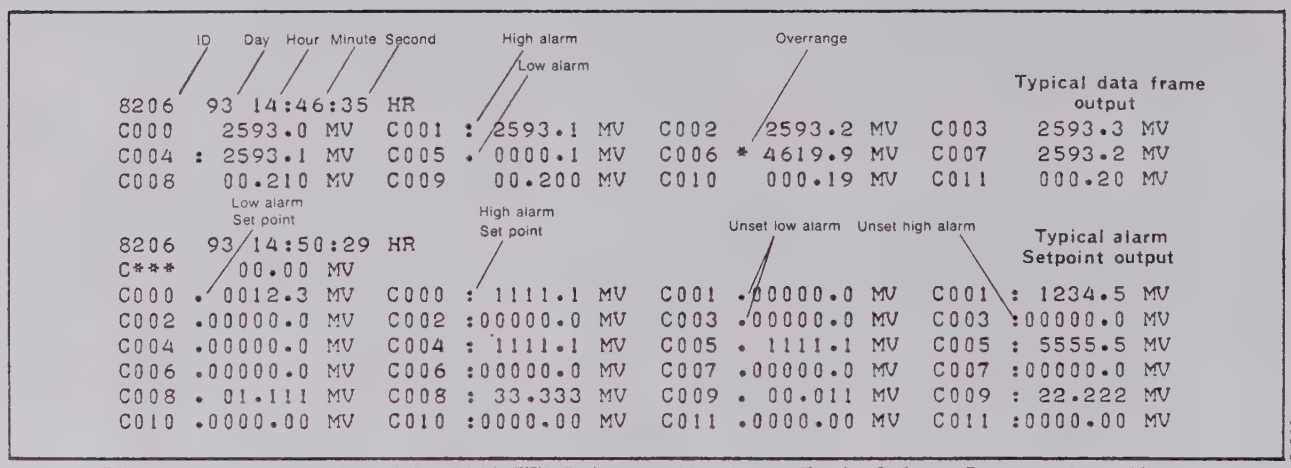


Figure B-12. Example of PD-2064-TTY Printout Showing a Typical Data Frame and an Alarm Setpoints Program.

B.3.4.3 INTERFACE CONFIGURATION

a. The teletype interface converts the acquired measured data and the programmed parameters of the data system into coded output signals which are received by an ASR-33 Teletypewriter, or any other mutually compatible output device. The coded output of the interface is formatted into a serial binary form, 8-bit, current-level code with all data signal bits conforming to the ASCII code specifications shown in Table B-1.2.

b. The serial, 8-bit, output code consists of seven data signal bits and a parity bit. Odd, even, or no parity must be specified when ordering. The parity type is preprogrammed in the output interface control ROM (no parity is standard). In addition to the serial transmission of the data signals, the interface also provides the medium for transferring the necessary housekeeping characters--such as, the "carriage return", "line feed", and "record separator" characters.

c. Components added to the Model PD-2064 data system for the teletype output interface option include the following (refer to Figure B-12.4 for locations):

(1) A pre-programmed ROM modular circuit (item ROM 5 or ROM 6) that plugs into the central processing unit (CPU) card. This customized integrated circuit contains stored instructions that automatically code and format the measured data before it is sent to the output device.

(2) A "Teletype (TTY) Interface" card (item 1) that plugs into the appropriate output connector (either "OUTPUT 1" or "OUTPUT 2") on the "Digital Mother Board". This card assembly conditions and sequences the output signals to match the input requirements of the teletype-compatible output device.

> NOTE: The plug-in location of the interface card corresponds with the plug-in location of the interface control ROM. Example: If external interfaced unit is designated as output device #1, the control ROM plugs into ROM 5 position on the CPU card, and the interface card plugs into the "OUTPUT 1" connector on "Digital Mother Board". Likewise, if external interfaced unit is designated as output device #2, the control ROM plugs into ROM 6 position on the CPU card, and the interface card plugs into the "OUTPUT 2" connector on "Digital Mother Board".

(3) An internal output cable (item 3) that connects the output of the interface card to a connector (item J4) on the PD-2064 rear panel.

(4) An external output cable assembly (item 4) that interconnects the Model PD-2064 and the ASR-33 output device (see Figure B-12.1).

B.3.4.4 PUTTING SYSTEM IN OPERATION

Set up operation of data system as follows:

a. Refer to "Installation" section of manual for PD-2064 mounting and signal connection instructions.

b. Interconnect PD-2064 to teletypewriter with external cable assembly. Install ASR-33 end of cable and make ASR-33 wiring modifications by following instructions given in Figure B-12.1. Plug PD-2064 end of cable into connector J4 on

INSTRUCTIONS FOR INSTALLING CABLE ASSEMBLY AND MODIFYING ASR-33 INTERNAL WIRING CONNECTIONS

A. TURN ASR-33 MODE SWITCH TO "OFF" POSITION, AND REMOVE POWER CORD FROM CONVENIENCE OUTLET.

B. REMOVE ASR-33 TOP COVER AS FOLLOWS:

(1) IF PAPER IS THREADED INTO PRINTER UNIT, TEAR PAPER OFF AT PAPER ROLL.

(2) IF PAPER TAPE IS BEING USED, REMOVE TAPE FROM TAPE PUNCH UNIT OR FROM TAPE READER UNIT.

(3) PULL AND REMOVE WHITE KNOB FROM PRINTER UNIT ROLLER.

(4) PULL AND REMOVE MODE SWITCH KNOB FROM FRONT OF MACHINE.

(5) REMOVE METAL ESCUTCHEON FROM FRONT OF MACHINE AS FOLLOWS: (a) PULL RIGHT-HAND END OF ESCUTCHEON OUTWARD SO THAT KNOB HOLE IN ESCUTCHEON CLEARS THE MODE SWITCH SHAFT. (b) THEN, SLIDE LEFT-HAND END OF ESCUTCHEON DOWNWARD AND REMOVE ESCUTCHEON FROM MACHINE.

(6) REMOVE SCREW FROM COVER AT LEFT SIDE OF TAPE READER UNIT.

(7) LOOSEN 4 SCREWS RETAINING COVER AT FRONT OF MACHINE.

(8) LOOSEN 3 KNURLED THUMBSCREWS AT REAR OF MACHINE.

(9) LIFT AND REMOVE TOP COVER FROM ASR-33.

C. MAKE FOLLOWING WIRING ADDITIONS AND CHANGES ON ASR-33.

(1) REMOVE 2 SCREWS THAT RETAIN INSULATING COVER ON TERMINAL BLOCK LOCATED AT REAR OF MACHINE. REMOVE COVER TO EXPOSE TERMINAL BLOCK WIRING.

(2) CONNECT GREEN (GRN) AND WHITE (WHT) WIRES OF CABLE ASSEMBLY TO BLOCK TERMINALS #6 AND #7, RESPECTIVELY.

(3) MOVE VIOLET (VIO) WIRE FROM TERMINAL #8 TO TERMINAL #9 ON TERMINAL BLOCK.

(4) AFTER CONNECTIONS ARE MADE TO TERMINAL BLOCK, RE-INSTALL INSULATING COVER ON BLOCK. USE ORIGINAL SCREW TO RETAIN COVER AT RIGHT-HAND END OF BLOCK. DISCARD NUT AND RETAIN SCREW (ITEM 1) THAT IS SUPPLIED WITH CABLE CLAMP (ITEM 2). RETAIN CABLE AT TERMINAL #1 END OF BLOCK WITH SCREW (ITEM 1) AND CABLE CLAMP (ITEM 2).

(5) MOVE BLUE (BLU) WIRE FROM TERMINAL #3 TO TERMINAL #4 ON CURRENT SOURCE RESISTOR.

(6) INSTALL RELAY MOUNTING BOARD ON EXISTING ASR-33 MOUNTING BRACKET WITH SCREWS (ITEM 3), WASHERS (ITEM 4), AND NUTS (ITEM 5).

(7) REMOVE ORANGE (ORN) WIRE FROM L1 TERMINAL ON MODE SWITCH. CONNECT THIS ORANGE WIRE AND THE ORANGE WIRE FROM TERMINAL #2 ON THE RELAY (K2) TO THE L2 TERMINAL ON MODE SWITCH.

(8) CONNECT BROWN (BRN) WIRE FROM TERMINAL 1 ON THE RELAY (K2) TO THE L1 TERMINAL ON MODE SWITCH.

D. REINSTALL ASR-33 TOP COVER. RETHREAD PRINTING PAPER AND/OR PAPER TAPE INTO MACHINE AS REQUIRED. RECONNECT POWER. TURN MODE SWITCH TO "OFF" POSITION.

E. INSERT PLUG (P4) OF CABLE INTO REAR PANEL CONNECTOR (J4) ON PD-2064.

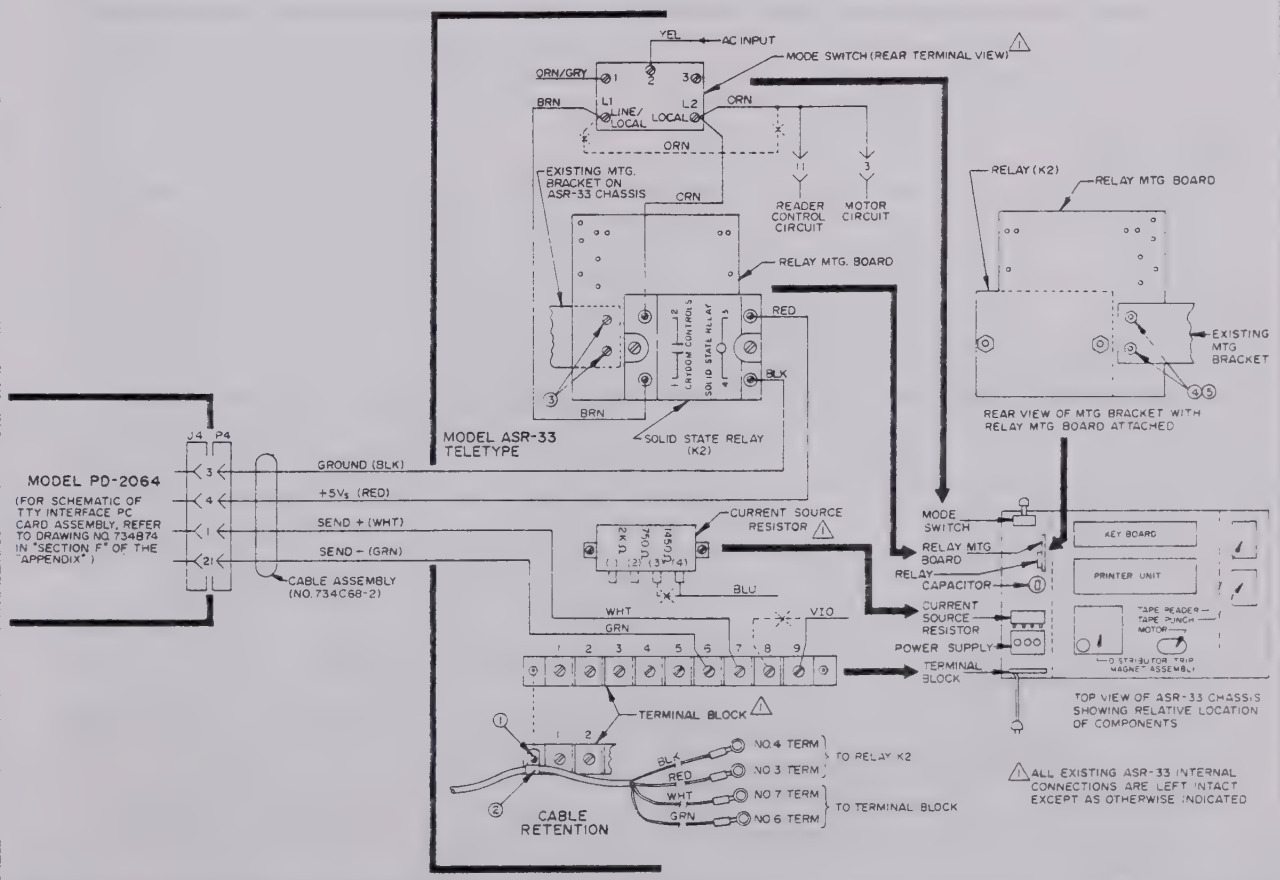


Figure B-12.1. "Write Only" Cable Interconnection Diagram for Teletype Interface.

Table B-1.2 PD-2064 Interface Code Output for Teletype Interface - Compatible Equipment.

	PD-2064 PRINTER DRUM CHARACTERS	CHARACTER, WORD, OR MESSAGE	ASCII CODE: BINARY CODE BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	BIT 8 (PARITY)†: EVEN PARITY	ODD PARITY	NO PARITY
COLUMNS 3-20 CHARACTERS **	0	0	0	0	0	0	1	1	0	0	1	1
	1	1	1	0	0	0	1	1	0	1	0	1
	2	2	0	1	0	0	1	1	0	1	0	1
	3	3	1	1	0	0	1	1	0	0	1	1
	4	4	0	0	1	0	1	1	0	1	0	1
	5	5	1	0	1	0	1	1	0	0	1	1
	6	6	0	1	1	0	1	1	0	0	1	1
	7	7	1	1	1	0	1	1	0	1	0	1
	8	8	0	0	0	1	1	1	0	1	0	1
	9	9	1	0	0	1	1	1	0	0	1	1
	-	-	1	0	1	1	0	1	0	0	1	1
	.	.	0	1	1	1	0	1	0	0	1	1
	:	:	0	1	0	1	1	1	0	0	1	1
	Ch	C	1	1	0	0	0	0	1	1	0	1
	*	*	0	1	0	1	0	1	0	1	0	1
COLUMN 2 CHARACTERS**	M	M	1	0	1	1	0	0	1	0	1	1
	K	K	1	1	0	1	0	0	1	0	1	1
	o	D	0	0	1	0	0	0	1	0	1	1
	L	L	0	0	1	1	0	0	1	1	0	1
	F	F	0	1	1	0	0	0	1	1	0	1
	R	R	0	1	0	0	1	0	1	1	0	1
	I	I	1	0	0	1	0	0	1	1	0	1
	A	A	1	0	0	0	0	0	1	0	1	1
	H	H	0	0	0	1	0	0	1	0	1	1
	W	W	1	1	1	0	1	0	1	1	0	1
	V	V	0	1	1	0	1	0	1	0	1	1
	P	P	0	0	0	0	1	0	1	0	1	1
	Gm	G	1	1	1	0	0	0	1	0	1	1
	Kg	K	1	1	0	1	0	0	1	0	1	1
	Km	K	1	1	0	1	0	0	1	0	1	1
	No Character (Column Space)	Word Separator (Space)	0	0	0	0	0	1	0	1	0	1
COLUMN 1 CHARACTERS **	V	V	0	1	1	0	1	0	1	0	1	1
	A	A	1	0	0	0	0	0	1	0	1	1
	W	W	1	1	1	0	1	0	1	1	0	1
	Hz	H	0	0	0	1	0	0	1	0	1	1
	Ω	O	1	1	1	1	0	0	1	1	0	1
	F	F	0	1	1	0	0	0	1	1	0	1
	C	C	1	1	0	0	0	0	1	1	0	1
	/M	M	1	0	1	1	0	0	1	0	1	1
	/S	S	1	1	0	0	1	0	1	0	1	1
	/H	H	0	0	0	1	0	0	1	0	1	1
	Va	V	0	1	1	0	1	0	1	0	1	1
	Vr	V	0	1	1	0	1	0	1	0	1	1
	B	B	0	1	0	0	0	0	1	0	1	1
	R	R	0	1	0	0	1	0	1	1	0	1
	SI	I	1	0	0	1	0	0	1	1	0	1
	No Character (Column Space)	Word Separator (Space)	0	0	0	0	0	1	0	1	0	1
SPECIAL WORD BITS OF INSTRUCTION	No Characters on Drum	Carriage Return	1	0	1	1	0	0	0	1	0	1
		Line Feed	0	1	0	1	0	0	0	0	1	1
		Record Separator	0	1	1	1	1	0	0	0	1	1

NOTES:

** Refer to Figure B-1 for Printer Drum Pattern.

† Parity Bit is Generated by PD-2064 Interface Option by Order. Unless Otherwise Specified, "No Parity" will be Supplied.

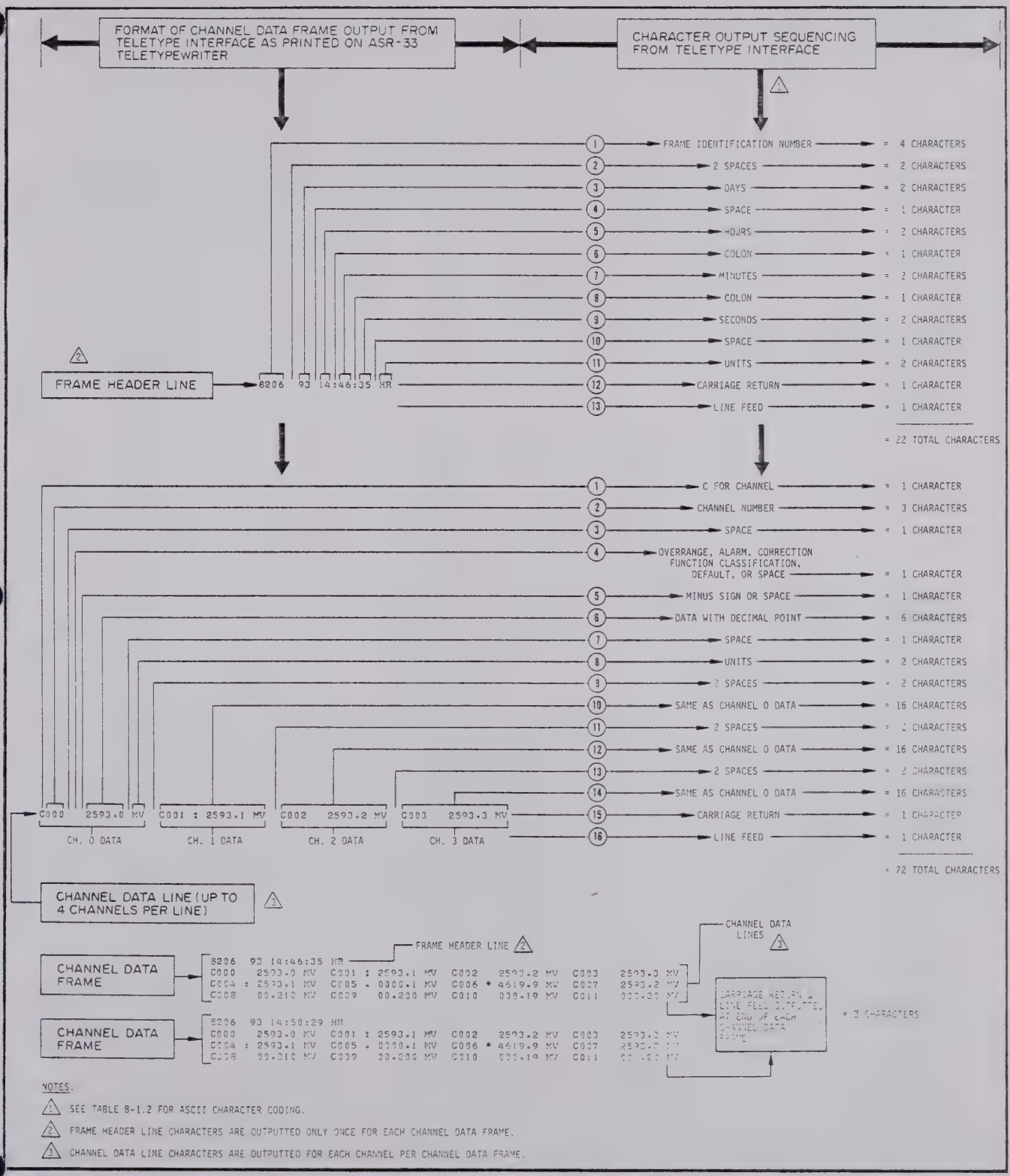

FORMAT OF CHANNEL DATA FRAME OUTPUT FROM TELETYPE INTERFACE AS PRINTED ON ASR-33 TELETYPEWRITER
CHARACTER OUTPUT SEQUENCING FROM TELETYPE INTERFACE
1 FRAME IDENTIFICATION NUMBER = 4 CHARACTERS
2 2 SPACES = 2 CHARACTERS
3 DAYS = 2 CHARACTERS
4 SPACE = 1 CHARACTER
5 HOURS = 2 CHARACTERS
6 COLON = 1 CHARACTER
7 MINUTES = 2 CHARACTERS
8 COLON = 1 CHARACTER
9 SECONDS = 2 CHARACTERS
10 SPACE = 1 CHARACTER
11 UNITS = 2 CHARACTERS
12 CARRIAGE RETURN = 1 CHARACTER
13 LINE FEED = 1 CHARACTER
= 22 TOTAL CHARACTERS
FRAME HEADER LINE
8206 93 14:46:35 HR
1 C FOR CHANNEL = 1 CHARACTER
2 CHANNEL NUMBER = 3 CHARACTERS
3 SPACE = 1 CHARACTER
4 OVERRANGE, ALARM, CORRECTION FUNCTION CLASSIFICATION, DEFAULT, OR SPACE = 1 CHARACTER
5 MINUS SIGN OR SPACE = 1 CHARACTER
6 DATA WITH DECIMAL POINT = 6 CHARACTERS
7 SPACE = 1 CHARACTER
8 UNITS = 2 CHARACTERS
9 2 SPACES = 2 CHARACTERS
10 SAME AS CHANNEL 0 DATA = 16 CHARACTERS
11 2 SPACES = 2 CHARACTERS
12 SAME AS CHANNEL 0 DATA = 16 CHARACTERS
13 2 SPACES = 2 CHARACTERS
14 SAME AS CHANNEL 0 DATA = 16 CHARACTERS
15 CARRIAGE RETURN = 1 CHARACTER
16 LINE FEED = 1 CHARACTER
= 72 TOTAL CHARACTERS
C000 2593.0 MV
C001 : 2593.1 MV
C002 2593.2 MV
C003 2593.3 MV
CH. 0 DATA
CH. 1 DATA
CH. 2 DATA
CH. 3 DATA
CHANNEL DATA LINE (UP TO 4 CHANNELS PER LINE)
CHANNEL DATA LINES
CHANNEL DATA FRAME
FRAME HEADER LINE
8206 93 14:46:35 HR
C000 2593.0 MV C001 : 2593.1 MV C002 2593.2 MV C003 2593.3 MV
C004 : 2593.1 MV C005 • 0000.1 MV C006 • 4619.9 MV C007 2593.2 MV
C008 00.210 MV C009 00.200 MV C010 000.19 MV C011 000.00 MV
CHANNEL DATA FRAME
8206 93 14:50:29 HR
C000 2593.0 MV C001 : 2593.1 MV C002 2593.2 MV C003 2593.3 MV
C004 : 2593.1 MV C005 • 0000.1 MV C006 • 4619.9 MV C007 2593.2 MV
C008 00.210 MV C009 00.200 MV C010 000.19 MV C011 000.00 MV
CARRIAGE RETURN & LINE FEED OUTPUTTED AT END OF EACH CHANNEL DATA FRAME
= 2 CHARACTERS
NOTES.
1 SEE TABLE B-1.2 FOR ASCII CHARACTER CODING.
2 FRAME HEADER LINE CHARACTERS ARE OUTPUTTED ONLY ONCE FOR EACH CHANNEL DATA FRAME.
3 CHANNEL DATA LINE CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PER CHANNEL DATA FRAME.
H490

Figure B-12.2. Output Format From Teletype Interface for Typical Channel Data Frames.

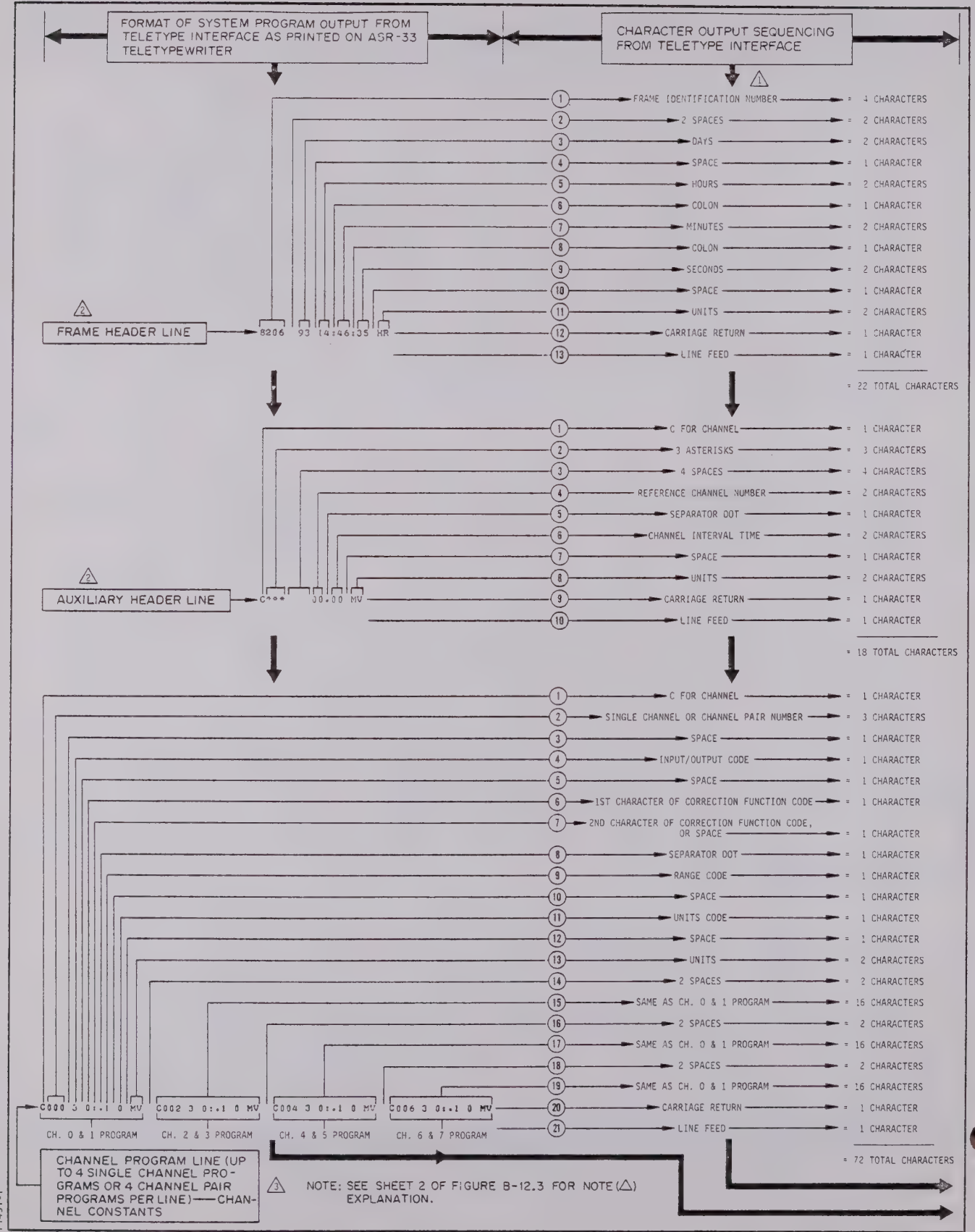

FORMAT OF SYSTEM PROGRAM OUTPUT FROM TELETYPE INTERFACE AS PRINTED ON ASR-33 TELETYPEWRITER
CHARACTER OUTPUT SEQUENCING FROM TELETYPE INTERFACE
1
FRAME IDENTIFICATION NUMBER = 4 CHARACTERS
2 SPACES = 2 CHARACTERS
DAYS = 2 CHARACTERS
SPACE = 1 CHARACTER
HOURS = 2 CHARACTERS
COLON = 1 CHARACTER
MINUTES = 2 CHARACTERS
COLON = 1 CHARACTER
SECONDS = 2 CHARACTERS
SPACE = 1 CHARACTER
UNITS = 2 CHARACTERS
CARRIAGE RETURN = 1 CHARACTER
LINE FEED = 1 CHARACTER
= 22 TOTAL CHARACTERS
2
FRAME HEADER LINE
8206 93 14:46:35 HR
C FOR CHANNEL = 1 CHARACTER
3 ASTERISKS = 3 CHARACTERS
4 SPACES = 4 CHARACTERS
REFERENCE CHANNEL NUMBER = 2 CHARACTERS
SEPARATOR DOT = 1 CHARACTER
CHANNEL INTERVAL TIME = 2 CHARACTERS
SPACE = 1 CHARACTER
UNITS = 2 CHARACTERS
CARRIAGE RETURN = 1 CHARACTER
LINE FEED = 1 CHARACTER
= 18 TOTAL CHARACTERS
2
AUXILIARY HEADER LINE
C*** 00.00 MV
C FOR CHANNEL = 1 CHARACTER
SINGLE CHANNEL OR CHANNEL PAIR NUMBER = 3 CHARACTERS
SPACE = 1 CHARACTER
INPUT/OUTPUT CODE = 1 CHARACTER
SPACE = 1 CHARACTER
1ST CHARACTER OF CORRECTION FUNCTION CODE = 1 CHARACTER
2ND CHARACTER OF CORRECTION FUNCTION CODE, OR SPACE = 1 CHARACTER
SEPARATOR DOT = 1 CHARACTER
RANGE CODE = 1 CHARACTER
SPACE = 1 CHARACTER
UNITS CODE = 1 CHARACTER
SPACE = 1 CHARACTER
UNITS = 2 CHARACTERS
2 SPACES = 2 CHARACTERS
SAME AS CH. 0 & 1 PROGRAM = 16 CHARACTERS
2 SPACES = 2 CHARACTERS
SAME AS CH. 0 & 1 PROGRAM = 16 CHARACTERS
2 SPACES = 2 CHARACTERS
SAME AS CH. 0 & 1 PROGRAM = 16 CHARACTERS
CARRIAGE RETURN = 1 CHARACTER
LINE FEED = 1 CHARACTER
= 72 TOTAL CHARACTERS
C000 3 0:.1 0 MV
C002 3 0:.1 0 MV
C004 3 0:.1 0 MV
C006 3 0:.1 0 MV
CH. 0 & 1 PROGRAM
CH. 2 & 3 PROGRAM
CH. 4 & 5 PROGRAM
CH. 6 & 7 PROGRAM
CHANNEL PROGRAM LINE (UP TO 4 SINGLE CHANNEL PROGRAMS OR 4 CHANNEL PAIR PROGRAMS PER LINE)—CHANNEL CONSTANTS
3
NOTE: SEE SHEET 2 OF FIGURE B-12.3 FOR NOTE (△) EXPLANATION.
P1491-1

Figure B-12.3. Output Format From Teletype Interface for Typical Channel Program Frames (Sheet 1).

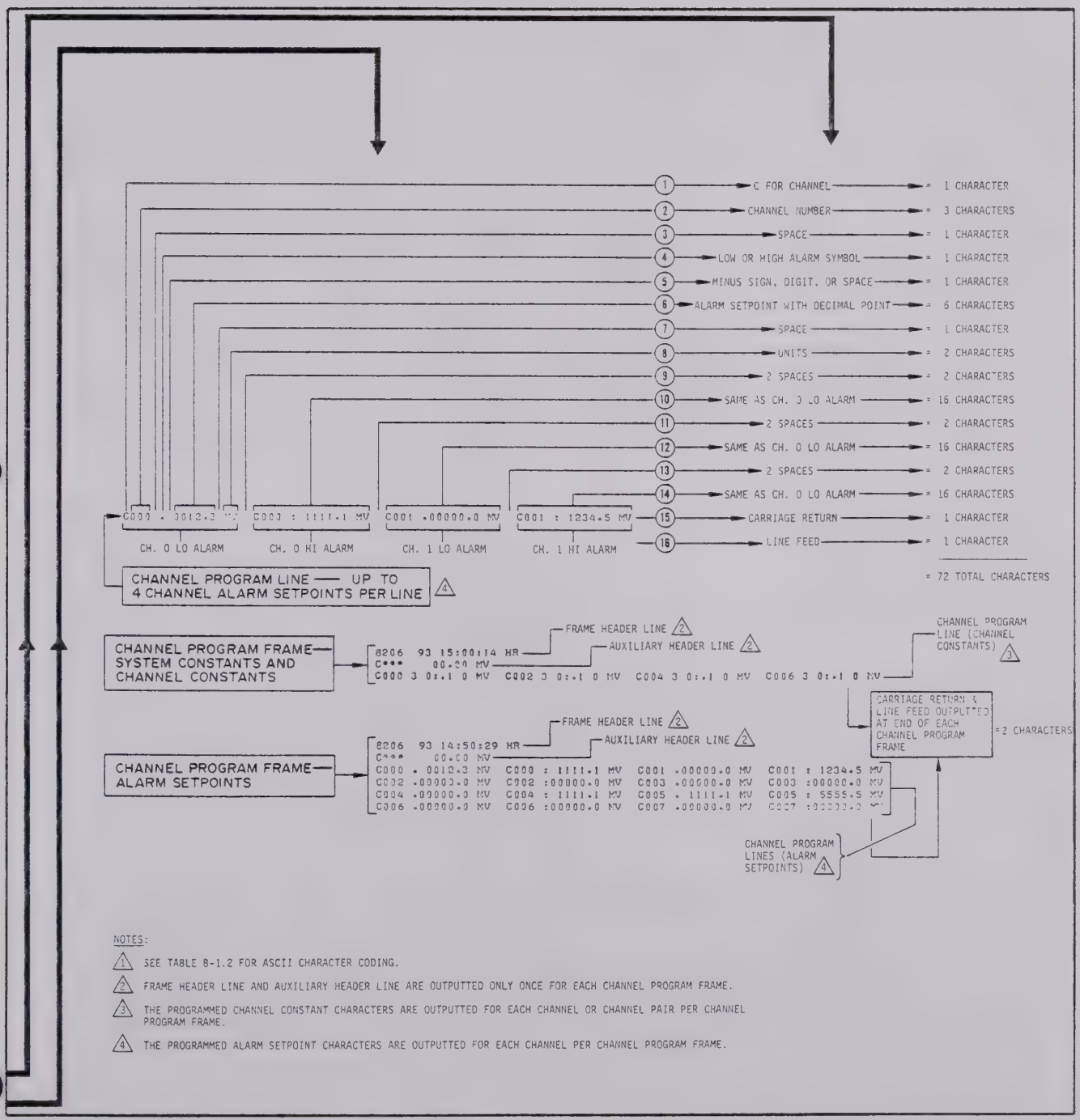

1 C FOR CHANNEL = 1 CHARACTER
2 CHANNEL NUMBER = 3 CHARACTERS
3 SPACE = 1 CHARACTER
4 LOW OR HIGH ALARM SYMBOL = 1 CHARACTER
5 MINUS SIGN, DIGIT, OR SPACE = 1 CHARACTER
6 ALARM SETPOINT WITH DECIMAL POINT = 6 CHARACTERS
7 SPACE = 1 CHARACTER
8 UNITS = 2 CHARACTERS
9 2 SPACES = 2 CHARACTERS
10 SAME AS CH. 0 LO ALARM = 16 CHARACTERS
11 2 SPACES = 2 CHARACTERS
12 SAME AS CH. 0 LO ALARM = 16 CHARACTERS
13 2 SPACES = 2 CHARACTERS
14 SAME AS CH. 0 LO ALARM = 16 CHARACTERS
15 CARRIAGE RETURN = 1 CHARACTER
16 LINE FEED = 1 CHARACTER
= 72 TOTAL CHARACTERS
C000 . 0012.3 MV
C000 : 1111.1 MV
C001 .00000.0 MV
C001 : 1234.5 MV
CH. 0 LO ALARM
CH. 0 HI ALARM
CH. 1 LO ALARM
CH. 1 HI ALARM
CHANNEL PROGRAM LINE — UP TO 4 CHANNEL ALARM SETPOINTS PER LINE 4
CHANNEL PROGRAM FRAME— SYSTEM CONSTANTS AND CHANNEL CONSTANTS
FRAME HEADER LINE 2
AUXILIARY HEADER LINE 2
8206 93 15:00:14 HR
C*** 00.00 MV
C000 3 0:.1 0 MV C002 3 0:.1 0 MV C004 3 0:.1 0 MV C006 3 0:.1 0 MV
CHANNEL PROGRAM LINE (CHANNEL CONSTANTS) 3
CARRIAGE RETURN & LINE FEED OUTPUTTED AT END OF EACH CHANNEL PROGRAM FRAME
=2 CHARACTERS
CHANNEL PROGRAM FRAME— ALARM SETPOINTS
FRAME HEADER LINE 2
AUXILIARY HEADER LINE 2
8206 93 14:50:29 HR
C*** 00.00 MV
C000 . 0012.3 MV C000 : 1111.1 MV C001 .00000.0 MV C001 : 1234.5 MV
C002 .00003.0 MV C002 :00000.0 MV C003 .00000.0 MV C003 :00000.0 MV
C004 .00000.0 MV C004 : 1111.1 MV C005 . 1111.1 MV C005 : 5555.5 MV
C006 .00000.0 MV C006 :00000.0 MV C007 .00000.0 MV C007 :00000.0 MV
CHANNEL PROGRAM LINES (ALARM SETPOINTS) 4
NOTES:
1 SEE TABLE B-1.2 FOR ASCII CHARACTER CODING.
2 FRAME HEADER LINE AND AUXILIARY HEADER LINE ARE OUTPUTTED ONLY ONCE FOR EACH CHANNEL PROGRAM FRAME.
3 THE PROGRAMMED CHANNEL CONSTANT CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL OR CHANNEL PAIR PER CHANNEL PROGRAM FRAME.
4 THE PROGRAMMED ALARM SETPOINT CHARACTERS ARE OUTPUTTED FOR EACH CHANNEL PER CHANNEL PROGRAM FRAME.
P1491-2

Figure B-12.3. Output Format From Teletype Interface for Typical Channel Program Frames (Sheet 2).

rear panel. Refer to ASR-33 instruction manual for procedures governing operation of teletypewriter. After interconnections are made, place ASR-33 mode switch in OFF position.

c. Connect analog and/or digital signals to desired PD-2064 channel inputs and make appropriate entries of system constants program, channel constants program, and alarm setpoints program (if "Alarm" option in included) through the instrument keyboard as follows:

(1) Turn PD-2064 "on" by pressing power key (key lights up). Permit instrument to warm up for approximately 30 seconds.

(2) Press INPUT key to engage "Input Mode" of operation (display reads all L's); then, press HALT key and hold key down for one or two seconds. While key is held down, notice that L's in display rapidly flash on and off.

> NOTE: Pressing HALT key automatically resets the "Next Scan" time to zero and permits the operator to program the system without interruptions from scanning and outputting operations that might be initiated from a previously programmed "Next Scan" time.

(3) Perform following procedures that are given on left-hand, foldout sheet of "Operational Flow Diagram" (located in "Operation" section of manual):

(a) Program system constants per Section 2. DO NOT program the "Next Scan" time at this point.

(b) Select desired channel numbers per Section 3.1 and program channel constant codes for selected channels per Sections 3.3 and 3.4. See programming codes available as stipulated on instrument Data Sheet or as shown on "Side 2" of the programming guide.

(c) Program alarm setpoints (if this option is included) for selected channels per Section 3.5.

d. Place ASR-33 mode switch in LINE position. With PD-2064 engaged in the "Input Mode", power should be applied to the teletypewriter motor through the solid state relay (K2).

e. Initiate check of a channel scan and output cycle by performing steps under Section 1.3.1 on the operational flow diagram foldout sheet. Display blanks out during scan and output operations. Measured channel data is fed to output devices according to previous keyboard programming.

f. Data is outputted to device #1 first, and then to device #2 in the following sequence: frame header line, specified analog channels (per programmed I-O code), and specified optional digital channels (per programmed I-O code). The necessary carriage returns, line feeds, and record separators are also performed at the proper time throughout the output cycle. See output formatting in Figure B-12.2.

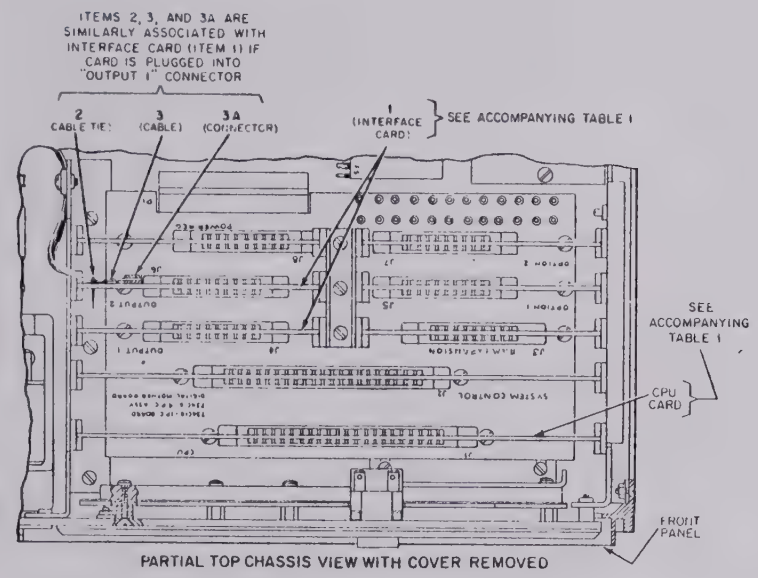
g. The total time required to output data is equal to the channel scan time plus the cumulative time that it takes for the output devices to receive and handle the data.

h. If "System Constant Printout" ("Program Printout") option is used, the system's programmed parameters may also be sent to each output device by following procedures under Sections 1.3.2 and 1.3.3 on the operational flow diagram foldout sheet. The system programming is outputted in duplicate--first to device #1, and then to device #2. See output formatting of system's program as given in Figure B-12.3.

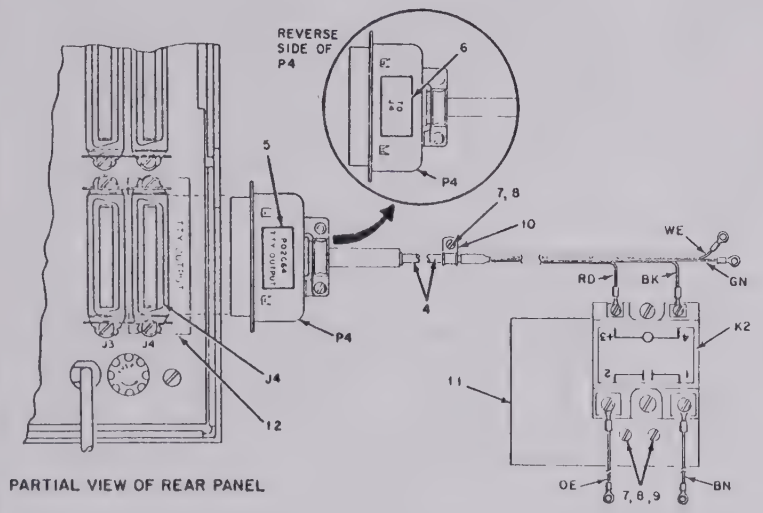
i. After output check has been made, reprogram desired "Next Scan" time with NEXT SCAN key by following procedures under Section 2 on the operational flow diagram foldout sheet.

j. If "Auto Mode" of operating system is desired, press AUTO key. With "Auto Mode" engaged, on-off control of the ASR-33 motor follows the operational mode of the PD-2064. That is, when PD-2064 powers down between channel frame scans in the "Auto Mode", AC power to the motor is switched off. When a scan occurs at the programmed scan interval time, the PD-2064 powers back up and causes power to be switched back on to the motor.

> NOTE: For further operational aspects of PD-2064, refer to "Operation" section of manual.


ITEMS 2, 3, AND 3A ARE SIMILARLY ASSOCIATED WITH INTERFACE CARD (ITEM 1) IF CARD IS PLUGGED INTO "OUTPUT 1" CONNECTOR
2 CABLE TIE
3 (CABLE)
3A (CONNECTOR)
1 (INTERFACE CARD)
SEE ACCOMPANYING TABLE 1
SEE ACCOMPANYING TABLE 1
CPU CARD
FRONT PANEL

PARTIAL TOP CHASSIS VIEW WITH COVER REMOVED



PARTIAL VIEW OF REAR PANEL

TABLE 1. COMPONENT LOCATIONS

Component	Plug-In Location	
	For Output Device #1:	For Output Device #2:
Interface Control ROM	ROM 5 Position on CPU Card*	ROM 6 Position on CPU Card*
Interface PC Card	OUTPUT 1†	OUTPUT 2†

*Output Interface ROMs are Specially Programmed for Their Particular Output Device. Therefore, ROMs are not Interchangeable Unless Both Output Devices are the Same. Also, See Figure 1-3 in Section 1 of Manual.

†Plug-In Locations ("OUTPUT 1" and "OUTPUT 2") of the Output Interface Card Correspond With the Output Device Control ROMs.

Example: If ROM 5 Position is Used, Appropriate Interface Card for Output Device #1 Plugs Into "OUTPUT 1" Connector. If ROM 6 Position is Used, Appropriate Interface Card for Output Device #2 Plugs Into "OUTPUT 2" Connector. If Both ROM 5 and ROM 6 Positions are Used, Appropriate Interface Cards for Output Devices #1 and #2 Plug Into "OUTPUT 1" and "OUTPUT 2" Connectors, Respectively.

TABLE 2. PARTS LIST

Item No.	Part No.	Description	Qty.
ROM 5 or ROM 6¶	Δ	ROM, Teletype Format and Driver	1
1	734C25-5	PC Card Assy., Teletype Interface ("Write" Only)	1
2	16755973-002	Strap, Cable Tie-Down	1
3	734C88	Cable Assy., Interface Card (28 In.)	1
3A	KMC30	.Connector, PC Card Cable (14 Pin)	1
J4	KBR3-40360	.Connector, Rear Panel Cable (36 Pin)	1
4	734C68-2	Cable Assy., External Output (20 Ft.) "Write" Only	1
P4	91500-2	.Connector (36 Pin)	1
5	734B48-3	.Decal, Connector ("PD2064 TTY Output")	1
6	734A56-4	.Decal, Connector ("To J4")	1
7	NX90506	.Screw, #5-40 x 3/8"	3
8	ND40122-7	.Nut, Hex; #5	3
9	ND40220-11	.Washer, Split; #5	2
10	ND40081-002	.Clamp, Cable	1
11	734C68-1	.Board, Relay Mounting	1
K2	REL25	.Relay, Solid State	1
12	734B71-1	.Tag, Connector Identification	1

¶ For ROM Location, Refer to Figure 1-3 in Section 1 of Manual.
Δ See Part No. Stamped or Written on Underside of ROM Body.

Figure B-12.4. Location of Components and Parts Listing for Teletype Interface Option.

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B.3.5 DATA COMMUNICATIONS INTERFACE

B.3.5.1 GENERAL

a. The RS-232-C interface option converts the digital data acquired by the PD-2064 into a serial binary form, 12 bit, USASCII code. This interface permits use of the PD-2064 with a variety of receivers and transmitters which likewise must be compatible with the RS-232-C interface. Data may be transmitted and received via land lines, by radio waves, and through telemetering mediums.

b. The interface is a recognized standard of the Electronic Industries Association (EIA) and is the basis of all United States data communications. Further, the interface meets the code of the International Committee CCITT (Consultative Committee on International Telegraphy and Telephony).

c. Advantages are that two-way interaction is possible in several modes, and transmission rates can equal that of high-speed teleprinters. Data transmission may be initiated from either the PD-2064 end or the other end of the line.

d. In addition to the conventional data communications telemetry applications, the RS-232-C interface is compatible with many data terminal devices. Typical of this equipment is the Texas Instrument Model TI-733 terminal shown in Figure B-13. A customized RS-232-C interface is offered for this terminal as an option. Other customized options can also be tailored to accommodate other RS-232-C interface-compatible equipment (consult factory).

e. The PD-2064 output may be configured at the data set end or the data terminal end of the RS-232-C circuit (see Table B-1.1). This choice is normally predicated by the receiving device. Affected items are control signals, origination of the data signals, and gender of the interconnecting cable(s). Consult factory for details.

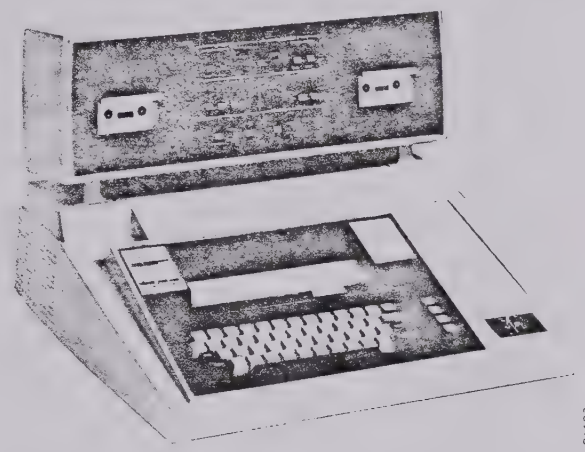


Figure B-13. Texas Instruments Model TI-733.

B.3.5.2 INTERFACE CHARACTERISTICS

Interface Type: RS-232-C, Type D (Half-Duplex Operation); configurations are available whereby PD-2064 functions as either a Data Terminal (standard) or as a Data Set (optional).

Output Code: USASCII 12 bit code; parity bit (8th bit) is always true; compatible with teletype equipment employing the RS-232-C interface (i.e., Texas Instruments "Silent 700" Electronic Data Terminals and others).

Baud Rates: Various baud rates are available as established in the ROM program. Only one rate available per ROM. Standard rate = 1200 baud as used for "Mode #1" operation described under paragraph B.3.5.3. Optional rate = 300 baud as used for "Mode #2" operation described under paragraph B.3.5.3. Other optional baud rates are available to match speed of the desired interface. Consult factory.

Signaling Voltages Supplied: Bipolar: +12V DC and -10V DC establish the logic levels. Logic 1 = from +3V to +25V (PD-2064 end of RS-232-C circuit supplies +12V nominal). Logic 0 = from -3V to -25V (PD-2064 end of RS-232-C circuit supplies -10V nominal). No change in logic level = from +3V to -3V or from -3V to +3V. Power supply protection and current limiting are provided. All signals conform to RS-232-C specifications.

B.3.5.3 OPERATIONAL MODES

The RS-232-C interface may be configured to operate in either one of two basic modes. These two modes are described as follows:

A. Mode #1

This mode is the standard mode and places the PD-2064 output at the data terminal end of the RS-232-C circuit (see Table B-1.1). Sequence of operations is as follows:

a. Application of power to PD-2064 activates the Data Terminal and sends a "Data Terminal Ready" signal to the data set end of the RS-232-C circuit.

b. With PD-2064 engaged in "Auto" mode, either a local timed-scan trigger or a remote frame trigger from the Data Set causes the following sequence of communications between the PD-2064 and the Data Set: (1) PD-2064 scans the input data, (2) PD-2064 sends a "Request to Send" signal, (3) PD-2064 receives "Clear to Send" and "Data Set Ready" signals, (4) PD-2064 transmits the data, and (5) PD-2064 returns to the "Auto" mode.

c. The PD-2064 remains idle until the next local timed-scan trigger or until it receives the next remote frame trigger from the Data Set. The PD-2064 must be engaged in the "Auto" mode for a remote scan to be effected.

d. With system engaged in "Input" mode of operation, either a local timed-scan trigger or the pressing of the PD-2064 MAN REC key initiates a scan and output cycle. The operational sequence of controlling the communications is the same as described in step b above, except that the PD-2064 remains engaged in the "Input" mode.

e. If PD-2064 receives "Clear to Send" and "Data Set Ready" signals within a time period of 9-10 seconds after the "Request to Send" signal has been sent, a complete channel data frame (frame header line and channel data lines) is outputted. If PD-2064 does not receive "Clear to Send" and "Data Set Ready" signals within a 9-10 second period after the "Request to Send" signal has been sent, the channel data frame is outputted without the frame header line as an indication that a default condition exists. This 9-10 second default time prevents tying up the entire data acquisition system in the event a response is not received from the data set end of the line due to a malfunction in the output device.

B. Mode #2

a. This optional mode is programmed so that the PD-2064 functions as the Data Set and the Texas Instruments Model TI-733 functions as the Data Terminal (see Table B-1.1).

b. In this mode, the PD-2064 initiates its own output by either (1) a local timed-scan trigger while system is engaged in "Input" or "Auto" mode, or (2) pressing the PD-2064 MAN REC key while system is engaged in "Input" mode.

c. There is no handshaking of control signals in this mode of operation; nor is there a default time prior to outputting of data to the data terminal.

B.3.5.4 INTERFACE CONFIGURATION

a. The RS-232-C interface converts the acquired measured data and the programmed parameters of the data system into coded output signals which are received by an RS-232-C interface-compatible output device. The coded output of the interface is formatted into a serial, 12-bit voltage-level[1] code with all data signal bits conforming to the ASCII code specifications shown in Table B-1.

b. The serial, 12-bit output code consists of seven data signal bits, a parity bit, and four other bits which are used to asynchronously transmit the data; that is, the requirement of a start bit precedes the transmission of each channel frame, and a series of three stop bits follows the transmission of each channel frame. Odd, even, or no parity must be specified when ordering. The parity type is preprogrammed in the output interface control ROM (no parity is standard).

c. In addition to the serial transmission of the data signals, the interface also provides the medium for transferring the necessary control and timing signals.

d. Data from the PD-2064 is sent in the same format as the Seiko printer output interface with the exception that the RS-232-C interface sends a record separator character between scans as shown in Figure B-13.2(A).

e. Components added to the Model PD-2064 data system for the RS-232-C output interface option include the following (refer to Figure B-13.3 for locations):

(1) A pre-programmed ROM modular circuit (item ROM 5 or ROM 6) that plugs into the central processing unit (CPU) card. This customized integrated circuit contains stored instructions that automatically code and format the measured data before it is sent to the output device.

[1] Current loop transmission of data signals is available as an option. Consult factory for details.

Table B-1. PD-2064 Interface Code Output for RS-232-C Interface - Compatible Equipment.

	PD-2064 PRINTER DRUM CHARACTERS	CHARACTER, WORD, OR MESSAGE	ASCII CODE BINARY CODE BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	BIT 8 (PARITY)† EVEN PARITY	ODD PARITY	NO PARITY
COLUMNS 3-20 CHARACTERS **	0	0	0	0	0	0	1	1	0	0	1	1
	1	1	1	0	0	0	1	1	0	1	0	1
	2	2	0	1	0	0	1	1	0	1	0	1
	3	3	1	1	0	0	1	1	0	0	1	1
	4	4	0	0	1	0	1	1	0	1	0	1
	5	5	1	0	1	0	1	1	0	0	1	1
	6	6	0	1	1	0	1	1	0	0	1	1
	7	7	1	1	1	0	1	1	0	1	0	1
	8	8	0	0	0	1	1	1	0	1	0	1
	9	9	1	0	0	1	1	1	0	0	1	1
	-	-	1	0	1	1	0	1	0	0	1	1
	.	.	0	1	1	1	0	1	0	0	1	1
	:	:	0	1	0	1	1	1	0	0	1	1
	Ch	C	1	1	0	0	0	0	1	1	0	1
	*	*	0	1	0	1	0	1	0	1	0	1
COLUMN 2 CHARACTERS**	M	M	1	0	1	1	0	0	1	0	1	1
	K	K	1	1	0	1	0	0	1	0	1	1
	○	D	0	0	1	0	0	0	1	0	1	1
	L	L	0	0	1	1	0	0	1	1	0	1
	F	F	0	1	1	0	0	0	1	1	0	1
	R	R	0	1	0	0	1	0	1	1	0	1
	I	I	1	0	0	1	0	0	1	1	0	1
	A	A	1	0	0	0	0	0	1	0	1	1
	H	H	0	0	0	1	0	0	1	0	1	1
	W	W	1	1	1	0	1	0	1	1	0	1
	V	V	0	1	1	0	1	0	1	0	1	1
	P	P	0	0	0	0	1	0	1	0	1	1
	Gm	G	1	1	1	0	0	0	1	0	1	1
	Kg	K	1	1	0	1	0	0	1	0	1	1
	Km	K	1	1	0	1	0	0	1	0	1	1
	No Character (Column Space)	Word Separator (Space)	0	0	0	0	0	1	0	1	0	1
COLUMN 1 CHARACTERS **	V	V	0	1	1	0	1	0	1	0	1	1
	A	A	1	0	0	0	0	0	1	0	1	1
	W	W	1	1	1	0	1	0	1	1	0	1
	Hz	H	0	0	0	1	0	0	1	0	1	1
	Ω	O	1	1	1	1	0	0	1	1	0	1
	F	F	0	1	1	0	0	0	1	1	0	1
	C	C	1	1	0	0	0	0	1	1	0	1
	/M	M	1	0	1	1	0	0	1	0	1	1
	/S	S	1	1	0	0	1	0	1	0	1	1
	/H	H	0	0	0	1	0	0	1	0	1	1
	Va	V	0	1	1	0	1	0	1	0	1	1
	Vr	V	0	1	1	0	1	0	1	0	1	1
	B	B	0	1	0	0	0	0	1	0	1	1
	R	R	0	1	0	0	1	0	1	1	0	1
	SI	I	1	0	0	1	0	0	1	1	0	1
	No Character (Column Space)	Word Separator (Space)	0	0	0	0	0	1	0	1	0	1
SPECIAL WORD BITS OF INSTRUCTION	No Characters on Drum	Carriage Return	1	0	1	1	0	0	0	1	0	1
		Line Feed	0	1	0	1	0	0	0	0	1	1
		Record Separator (ETB)	1	1	1	0	1	0	0	0	1	1

NOTES:

** Refer to Figure B-1 for Printer Drum Pattern.

† Parity Bit is Generated by PD-2064 Interface Option by Order. Unless Otherwise Specified, "No Parity" will be Supplied.

Table B-1.1. RS-232-C (Type D) Interface - Compatible Configurations.

OPERATIONAL MODE	EXTERNAL CABLE INTERCONNECTIONS	OUTPUT FORMAT	J1 CONNECTOR PIN NO.	CIRCUIT	SIGNAL NAME	FUNCTION
MODE #1 (Standard ROM Program-- PD-2064 Used as a Data Terminal and a Computer or Modem Typically Used as the Data Set)	Figure B-13.1(A)	Figure B-13.2(A)	1	AA	Protective ground	Chassis ground
			2	BA	Transmitted data	PD-2064 places data on this line.
			3	BB	Received data	No function (Not in ROM program).
			4	CA	Request to send	PD-2064 places this line high to send.
			5	CB	Clear to send	These two lines must be placed high by the output device to enable the PD-2064 output.
			6	CC	Data set ready	
			7	AB	Signal ground	Digital ground
			8	CF	Received line signal detector	No function (Not in ROM program).
			20	CD	Data terminal ready	This line goes high when power to PD-2064 is turned "on".
			22	CE	Ring indicator	If system is engaged in "Auto" mode of operation, driving this line high by the output device causes a remote frame trigger (scan and output) from the PD-2064.
MODE #2 (Optional ROM Program-- PD-2064 Used as a Data Set and Texas Instruments Model TI-733 Used as a Data Terminal)	Figure B-13.1(B)	Figure B-13.2(B)	1	AA	Protective ground	Chassis ground
			2	BA	Transmitted data	No function (Not in ROM program).
			3	BB	Received data	PD-2064 places data on this line.
			4	CA	Request to send	No function (Not in ROM program).
			5	CB	Clear to send	These two lines go high when power to PD-2064 is turned "on".
			6	CC	Data set ready	
			7	AB	Signal ground	Digital ground
			8	CF	Received line signal detector	PD-2064 places this line high to send.
			20	CD	Data terminal ready	No function (Not in ROM program).
			22	CE	Ring indicator	Not used.

(2) A "RS-232-C Interface" card (item 1) that plugs into the appropriate output connector (either "OUTPUT 1" or "OUTPUT 2") on the "Digital Mother Board". This card assembly conditions and sequences the output signals to match the input requirements of the RS-232-C interface-compatible output device.

> NOTE: The plug-in location of the interface card corresponds with the plug-in location of the interface control ROM. Example: If external interfaced unit is designated as output device #1, the control ROM plugs into ROM 5 position on the CPU card, and the interface card plugs into the "OUTPUT 1" connector on "Digital Mother Board". Likewise, if external interfaced unit is designated as output device #2, the control ROM plugs into ROM 6 position on the CPU card, and the interface card plugs into the "OUTPUT 2" connector on "Digital Mother Board".

(3) An internal output cable (item 3) that connects the output of the interface card to a connector (item J4) on the PD-2064 rear panel.

(4) An external output cable assembly (item 4) that interconnects the Model PD-2064 and the output device (see Figure B-13.1).

B.3.5.5 PUTTING SYSTEM IN OPERATION

Set up operation of data system as follows:

a. Refer to "Installation" section of manual for instrument mounting and signal connection instructions.

b. Connect analog and/or digital signals to desired channel inputs and make appropriate entries of system constants program, channel constants program, and alarm setpoints program (if "Alarm" option is included) through the instrument keyboard as follows:

(1) Turn PD-2064 "on" by pressing power key (key lights up). Permit instrument to warm up for approximately 30 seconds.

(2) Press INPUT key to engage "Input Mode" of operation (display reads all L's); then, press HALT key and hold key down for one or two seconds. While key is held down, notice that L's in display rapidly flash on and off.

> NOTE: Pressing HALT key automatically resets the "Next Scan" time to zero and permits the operator to program the system without interruptions from scanning and outputting operations that might be initiated from a previously programmed "Next Scan" time.

(3) Perform following procedures that are given on left-hand, foldout sheet of "Operational Flow Diagram" (located in "Operation" section of manual).

(a) Program system constants per Section 2. DO NOT program the "Next Scan" time at this point.

(b) Select desired channel numbers per Section 3.1 and program channel constant codes for selected channels per Sections 3.3 and 3.4. See programming codes available as stipulated on instrument Data Sheet or as shown on "Side 2" of the programming guide.

(c) Program alarm setpoints (if this option is included) for selected channels per Section 3.5.

c. Interconnect PD-2064 to output device with cable assembly. Plug PD-2064 end of cable into connector J4 on rear panel, and plug other end of cable into appropriate connector on output device. Refer to the appropriate equipment manufacturer's instruction booklet for procedures governing operation of output device.

d. Apply power to output device after it has been prepared for operation.

e. Initiate check of a channel scan and output cycle by performing steps under Section 1.3.1 on the operational flow diagram foldout sheet. Display blanks out during scan and output operations. Measured channel data is fed to output devices according to previous keyboard programming.

f. Data is outputted to device #1 first, and then to device #2 in the following sequence: frame header line, specified analog channels (per programmed I-O code), and specified optional digital channels (per programmed I-O code). The necessary carriage returns, line feeds, and record separators are also performed at the proper times throughout the output cycle. See output formatting in Figure B-13.2.

g. The total time required to output data is equal to the channel scan time plus the cumulative time that it takes for the output devices to receive and handle the data.

h. If "System Constant Printout" ("Program Printout") option is used, the system's programmed parameters may also be sent to each output device by following procedures under Sections 1.3.2 and 1.3.3 on the operational flow diagram

foldout sheet. The system programming is outputted in duplicate -- first to device #1, and then to device #2.

i. After output check has been made, reprogram desired "Next Scan" time with NEXT SCAN key by following procedures under Section 2 on the operational flow diagram foldout sheet.

j. If "Auto" mode of operating system is desired, press AUTO key.

NOTE: For further operational aspects of PD-2064, refer to "Operation" section of manual.

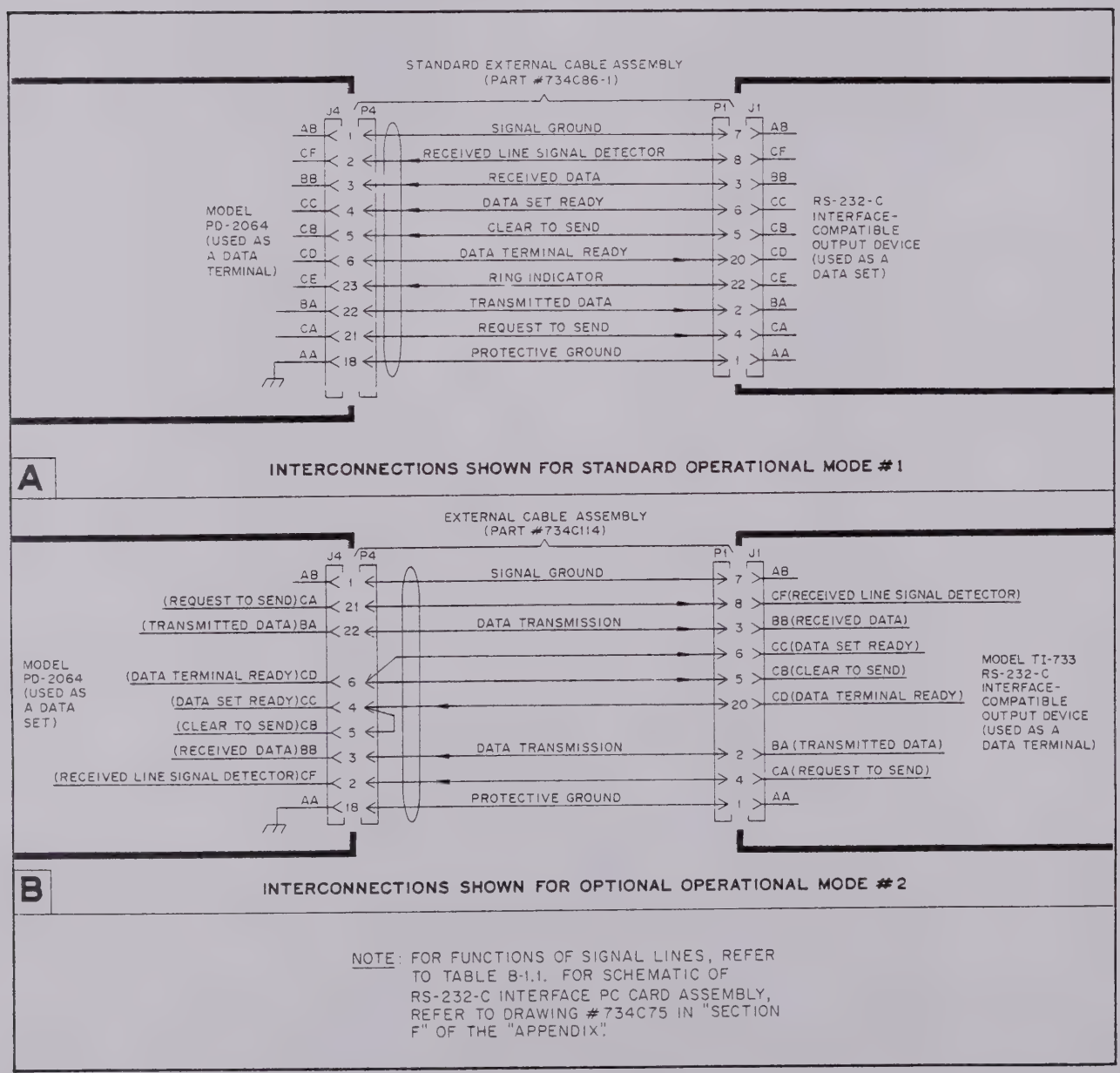

STANDARD EXTERNAL CABLE ASSEMBLY
(PART #734C86-1)
J4
P4
P1
J1
MODEL PD-2064 (USED AS A DATA TERMINAL)
AB 1 SIGNAL GROUND 7 AB
CF 2 RECEIVED LINE SIGNAL DETECTOR 8 CF
BB 3 RECEIVED DATA 3 BB
CC 4 DATA SET READY 6 CC
CB 5 CLEAR TO SEND 5 CB
CD 6 DATA TERMINAL READY 20 CD
CE 23 RING INDICATOR 22 CE
BA 22 TRANSMITTED DATA 2 BA
CA 21 REQUEST TO SEND 4 CA
AA 18 PROTECTIVE GROUND 1 AA
RS-232-C INTERFACE-COMPATIBLE OUTPUT DEVICE (USED AS A DATA SET)
A
INTERCONNECTIONS SHOWN FOR STANDARD OPERATIONAL MODE #1
EXTERNAL CABLE ASSEMBLY
(PART #734C114)
J4
P4
P1
J1
MODEL PD-2064 (USED AS A DATA SET)
AB 1 SIGNAL GROUND 7 AB
(REQUEST TO SEND)CA 21 8 CF(RECEIVED LINE SIGNAL DETECTOR)
(TRANSMITTED DATA)BA 22 DATA TRANSMISSION 3 BB(RECEIVED DATA)
6 CC(DATA SET READY)
(DATA TERMINAL READY)CD 6 5 CB(CLEAR TO SEND)
(DATA SET READY)CC 4 20 CD(DATA TERMINAL READY)
(CLEAR TO SEND)CB 5
(RECEIVED DATA)BB 3 DATA TRANSMISSION 2 BA(TRANSMITTED DATA)
(RECEIVED LINE SIGNAL DETECTOR)CF 2 4 CA(REQUEST TO SEND)
AA 18 PROTECTIVE GROUND 1 AA
MODEL TI-733 RS-232-C INTERFACE-COMPATIBLE OUTPUT DEVICE (USED AS A DATA TERMINAL)
B
INTERCONNECTIONS SHOWN FOR OPTIONAL OPERATIONAL MODE #2
NOTE: FOR FUNCTIONS OF SIGNAL LINES, REFER TO TABLE B-1.1. FOR SCHEMATIC OF RS-232-C INTERFACE PC CARD ASSEMBLY, REFER TO DRAWING #734C75 IN "SECTION F" OF THE "APPENDIX".
P1479

Figure B-13.1. Cable Interconnection Diagrams for RS-232-C Interface.

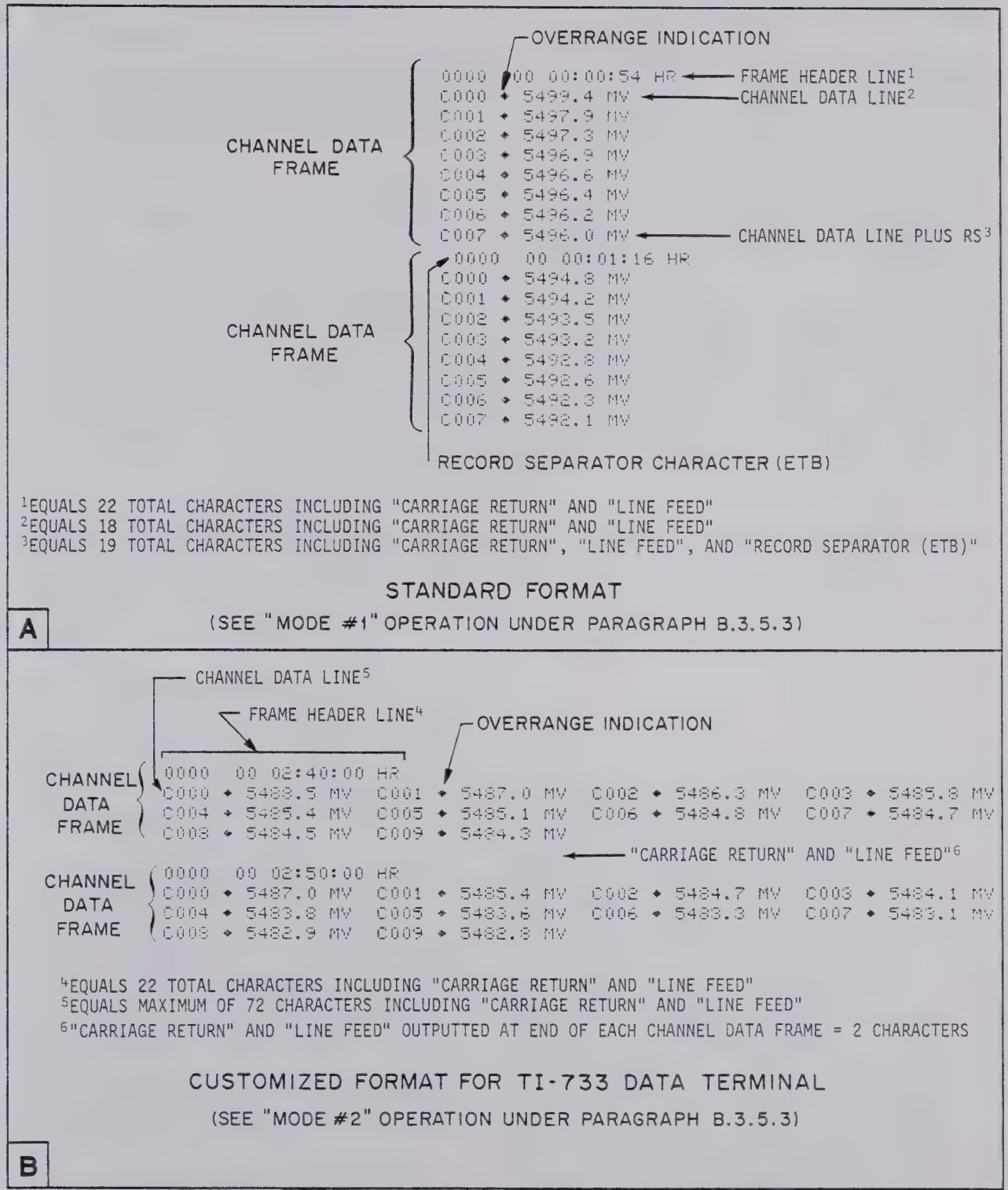
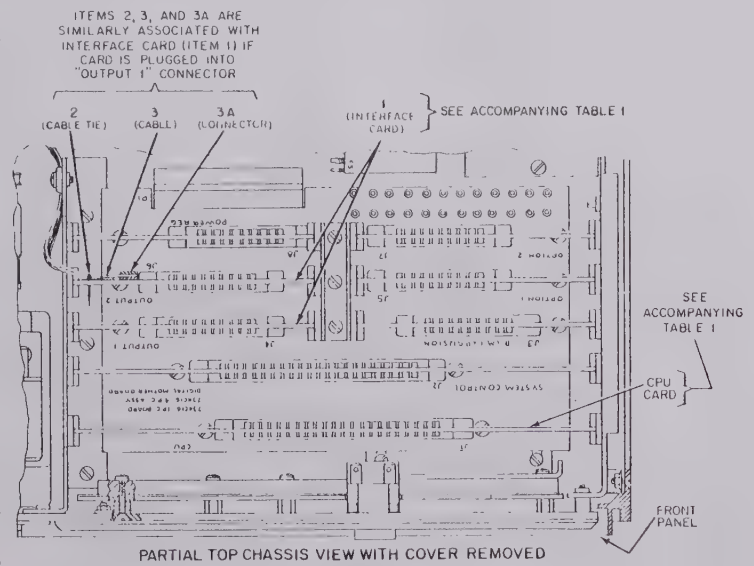
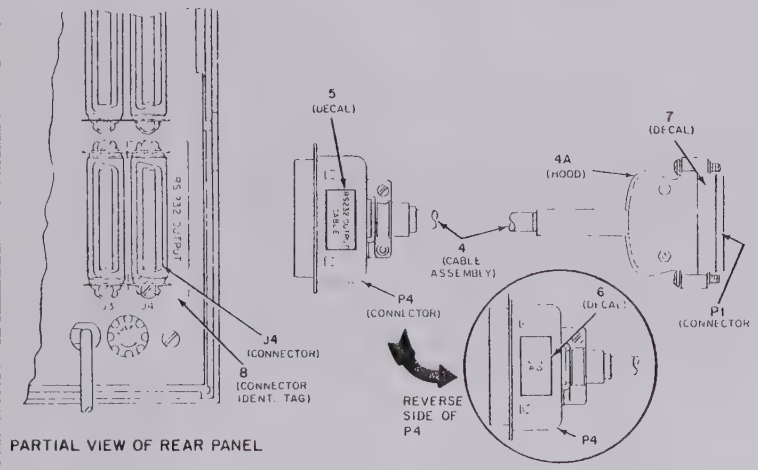

OVERRANGE INDICATION
CHANNEL DATA FRAME
0000 00 00:00:54 HR
FRAME HEADER LINE[1]
C000 * 5499.4 MV
CHANNEL DATA LINE[2]
C001 * 5497.9 MV
C002 * 5497.3 MV
C003 * 5496.9 MV
C004 * 5496.6 MV
C005 * 5496.4 MV
C006 * 5496.2 MV
C007 * 5496.0 MV
CHANNEL DATA LINE PLUS RS[3]
CHANNEL DATA FRAME
0000 00 00:01:16 HR
C000 * 5494.8 MV
C001 * 5494.2 MV
C002 * 5493.5 MV
C003 * 5493.2 MV
C004 * 5492.8 MV
C005 * 5492.6 MV
C006 * 5492.3 MV
C007 * 5492.1 MV
RECORD SEPARATOR CHARACTER (ETB)
[1]EQUALS 22 TOTAL CHARACTERS INCLUDING "CARRIAGE RETURN" AND "LINE FEED"
[2]EQUALS 18 TOTAL CHARACTERS INCLUDING "CARRIAGE RETURN" AND "LINE FEED"
[3]EQUALS 19 TOTAL CHARACTERS INCLUDING "CARRIAGE RETURN", "LINE FEED", AND "RECORD SEPARATOR (ETB)"
STANDARD FORMAT
(SEE "MODE #1" OPERATION UNDER PARAGRAPH B.3.5.3)
A
CHANNEL DATA LINE[5]
FRAME HEADER LINE[4]
OVERRANGE INDICATION
CHANNEL DATA FRAME
0000 00 02:40:00 HR
C000 * 5488.5 MV C001 * 5487.0 MV C002 * 5486.3 MV C003 * 5485.8 MV
C004 * 5485.4 MV C005 * 5485.1 MV C006 * 5484.8 MV C007 * 5484.7 MV
C008 * 5484.5 MV C009 * 5484.3 MV
"CARRIAGE RETURN" AND "LINE FEED"[6]
CHANNEL DATA FRAME
0000 00 02:50:00 HR
C000 * 5487.0 MV C001 * 5485.4 MV C002 * 5484.7 MV C003 * 5484.1 MV
C004 * 5483.8 MV C005 * 5483.6 MV C006 * 5483.3 MV C007 * 5483.1 MV
C008 * 5482.9 MV C009 * 5482.8 MV
[4]EQUALS 22 TOTAL CHARACTERS INCLUDING "CARRIAGE RETURN" AND "LINE FEED"
[5]EQUALS MAXIMUM OF 72 CHARACTERS INCLUDING "CARRIAGE RETURN" AND "LINE FEED"
[6]"CARRIAGE RETURN" AND "LINE FEED" OUTPUTTED AT END OF EACH CHANNEL DATA FRAME = 2 CHARACTERS
CUSTOMIZED FORMAT FOR TI-733 DATA TERMINAL
(SEE "MODE #2" OPERATION UNDER PARAGRAPH B.3.5.3)
B
P1480A

Figure B-13.2. RS-232-C Interface Output Formats.


ITEMS 2, 3, AND 3A ARE SIMILARLY ASSOCIATED WITH INTERFACE CARD (ITEM 1) IF CARD IS PLUGGED INTO "OUTPUT 1" CONNECTOR
2 (CABLE TIE)
3 (CABLE)
3A (CONNECTOR)
1 (INTERFACE CARD)
SEE ACCOMPANYING TABLE 1
SEE ACCOMPANYING TABLE 1
CPU CARD
FRONT PANEL

PARTIAL TOP CHASSIS VIEW WITH COVER REMOVED



PARTIAL VIEW OF REAR PANEL

TABLE 1. COMPONENT LOCATIONS

Component	Plug-In Location	
	For Output Device #1:	For Output Device #2:
Interface Control ROM	ROM 5 Position on CPU Card*	ROM 6 Position on CPU Card*
Interface PC Card	OUTPUT 1†	OUTPUT 2†

*Output Interface ROMs are Specially Programmed for Their Particular Output Device. Therefore, ROMs are not Interchangeable Unless Both Output Devices are the Same. Also, See Figure 1-3 in Section 1 of Manual.

†Plug-In Locations ("OUTPUT 1" and "OUTPUT 2") of the Output Interface Card Correspond With the Output Device Control ROMs.

Example: If ROM 5 Position is Used, Appropriate Interface Card for Output Device #1 Plugs Into "OUTPUT 1" Connector. If ROM 6 Position is Used, Appropriate Interface Card for Output Device #2 Plugs Into "OUTPUT 2" Connector. If Both ROM 5 and ROM 6 Positions are Used, Appropriate Interface Cards for Output Devices #1 and #2 Plug Into "OUTPUT 1" and "OUTPUT 2" Connectors, Respectively.

TABLE 2. PARTS LIST

Item No.	Part No.	Description	Qty.
ROM 5 or ROM 6¶	Δ	ROM, RS-232-C Format and Driver	1
1	734C63-4	PC Card Assy., RS-232-C Interface	1
2	16755973-002	Strap, Cable Tie-Down	1
3	734C81	Cable Assy., Interface Card (26 In.)	1
3A	KPC50	. Connector, PC Card Cable (24 Pin)	1
J4	KBR3-40360	. Connector, Rear Panel Cable (36 Pin)	1
4	734C86-1	Standard Cable Assy., External Output (8 Ft.)	1 A/R
4	734L114	T.I. Cable Assy., External Output (8 Ft.)	1 A/R
4A	KMC36	. Hood, Connector	1
5	734B48-8	. Decal, Connector ("RS232 Output Cable")	1
6	734A56-4	. Decal, Connector ("To J4")	1
7	759A10-1	. Decal, Connector ("RS232"); For Standard Cable Assy. Only	1 A/R
P1	KMC35	. Connector, Standard Cable (25 Pin)	1 A/R
P1	KMC37	. Connector, T. I. Cable (25 Pin)	1 A/R
P4	91500-2	. Connector (36 Pin)	1
8	734B71-4	Tag, Connector Identification	1

Δ See Part No. Stamped or Written on Underside of ROM Body.
¶ For ROM Location, Refer to Figure 1-3 in Section 1 of Manual.

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Figure B-13.3. Location of Components and Parts Listing for RS-232-C Interface Option.

B.3.6 ALARM RELAY OUTPUTS

B.3.6.1 GENERAL

a. The alarm relay output option may be combined with the basic alarm output functions of the PD-2064 to provide output contact closures for measured channel signals that are detected in the "alarm" condition.

b. The contact closures consist of small, SPST, reed-type relays having a rating of 10VA (0.5A maximum) or 100V DC (maximum) into a resistive load.

> CAUTION: Relay ratings should not be exceeded by the external load configuration.

c. The output relays are mounted on PC cards. Depending on the various other options that may be included in the data system, the alarm relay cards either plug into the auxiliary card cage at the rear of the PD-2064, or into card cage #2 on the expander box (see Figure B-15).

d. Alarm output configurations may consist of: (1) only one relay to provide a common-alarm output for as many as 64 channels (0-63) that have been programmed with alarm setpoints, or (2) up to a maximum of 64 relays (with or without the common-alarm relay) to provide individual channel-alarm outputs for as many as 64 channels (0-63) that have been programmed with alarm setpoints.

e. The individual channel-alarm relays are installed on consecutive channels and in groups of 8 (without common alarm), 9 (with common alarm), or 16 on a card as shown in Figure B-14. Programming of the channel alarm setpoints (and associated alarm outputs) must be consecutive, beginning with channel zero and ending with the last desired alarm channel (up to maximum of 64).

> NOTE: See paragraphs 3.5.3.1 and 3.5.3.4 in "Operation" section of manual for "alarm" programming procedures.

f. The common-alarm or an individual channel-alarm relay becomes energized for an "alarm" condition after the data scan and output cycle have been completed. A particular relay remains energized until subsequent channel scans no longer encounter an "alarm" condition.

g. For additional description of the "alarm" option functions, refer to sub-paragraphs under main paragraph 3.5.3 in "Operation" section of manual.

B.3.6.2 RELAY OUTPUT CONFIGURATIONS AND CONNECTIONS

a. Table B-4 lists the alarm output configurations (with or without the common-alarm output) in multiples of 8 channels for up to a maximum of 64 channels. For each configuration of alarm outputs, read across table to right to find: (1) output card #'s used, (2) part number of each card used, (3) the relay configuration on each card used as indicated in Figure B-14, (4) the plug-in location of each card used as indicated in Figure B-15, and (5) output connections to each card used as designated in Table B-5.

b. The channel relay-output connections on each card are designated in Table B-5. The external connections are made to a 36-pin, solder-terminal connector which mates with the edge connector of the relay card (Figure B-14). Solder connections to pins should be made with a good quality, self-fluxing, multicore solder having a composition of 60% tin and 40% lead.

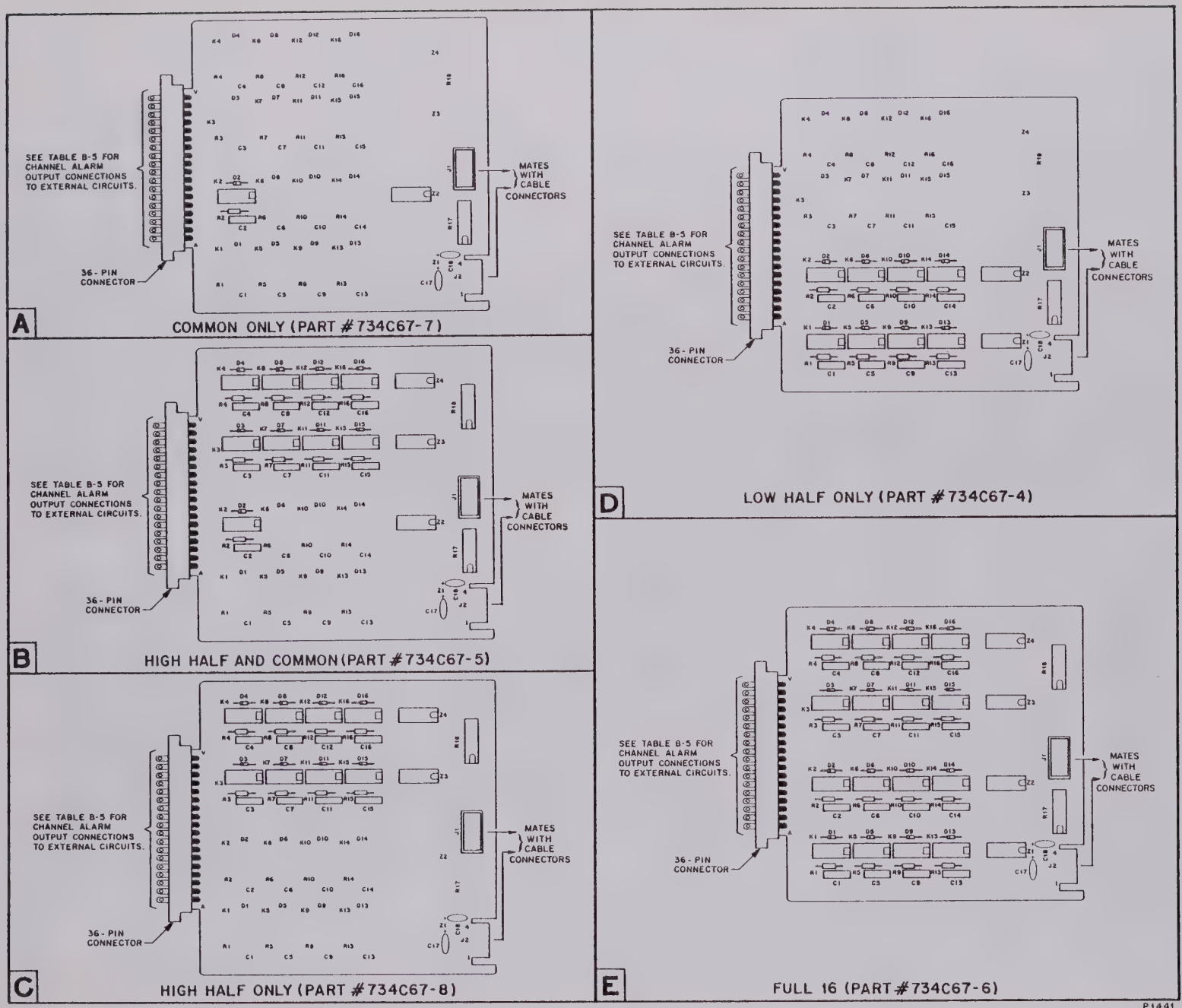
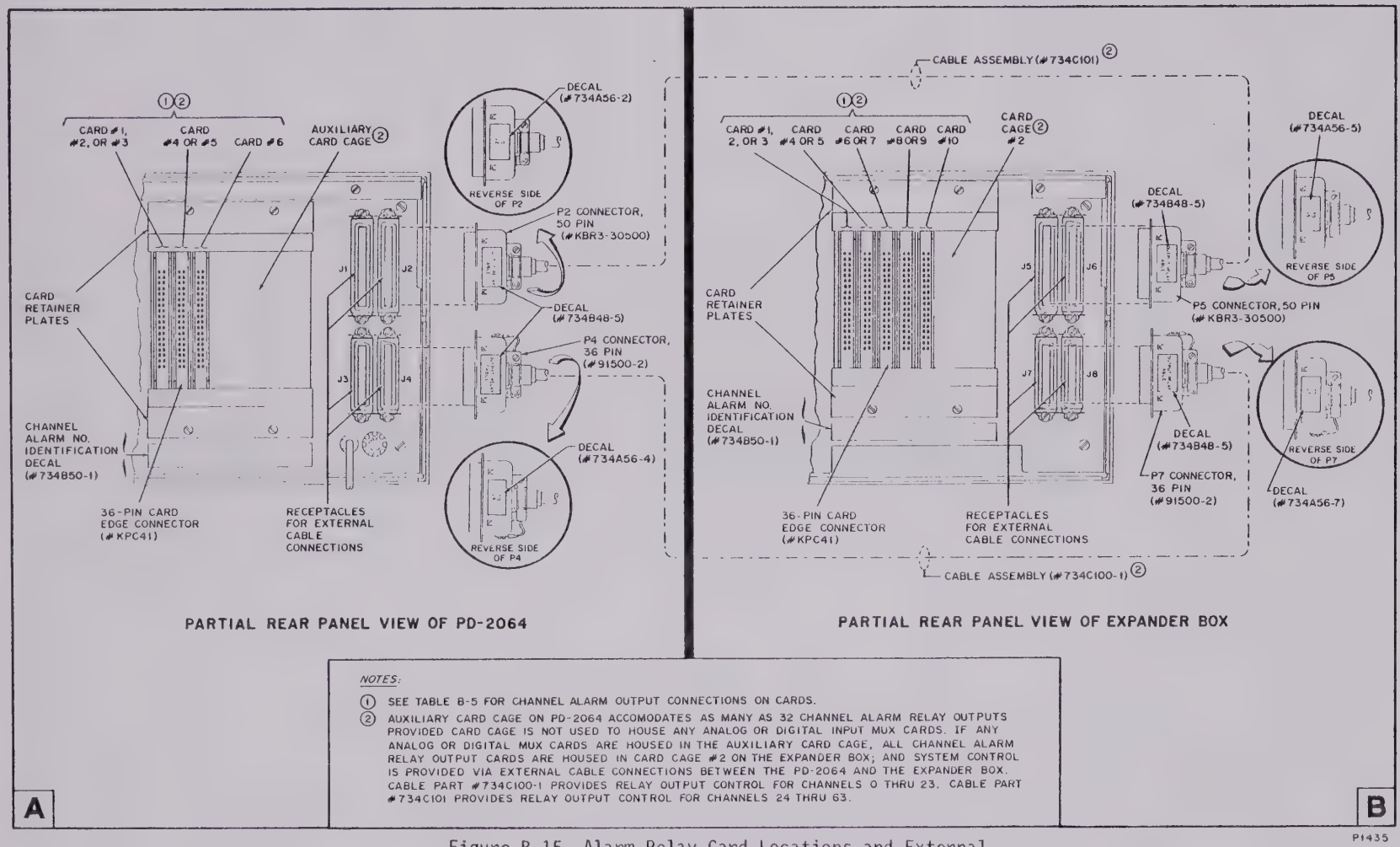


Figure B-14. Alarm Relay Card Configurations.



NOTES:

(1) SEE TABLE B-5 FOR CHANNEL ALARM OUTPUT CONNECTIONS ON CARDS.

(2) AUXILIARY CARD CAGE ON PD-2064 ACCOMODATES AS MANY AS 32 CHANNEL ALARM RELAY OUTPUTS PROVIDED CARD CAGE IS NOT USED TO HOUSE ANY ANALOG OR DIGITAL INPUT MUX CARDS. IF ANY ANALOG OR DIGITAL MUX CARDS ARE HOUSED IN THE AUXILIARY CARD CAGE, ALL CHANNEL ALARM RELAY OUTPUT CARDS ARE HOUSED IN CARD CAGE #2 ON THE EXPANDER BOX; AND SYSTEM CONTROL IS PROVIDED VIA EXTERNAL CABLE CONNECTIONS BETWEEN THE PD-2064 AND THE EXPANDER BOX. CABLE PART #734C100-1 PROVIDES RELAY OUTPUT CONTROL FOR CHANNELS 0 THRU 23. CABLE PART #734C101 PROVIDES RELAY OUTPUT CONTROL FOR CHANNELS 24 THRU 63.

Figure B-15. Alarm Relay Card Locations and External Control Cable Interconnections.

Table B-4. Alarm Output Configurations.

NUMBER OF CHANNEL ALARM OUTPUTS		ALARM RELAY OUTPUT CARDS USED		RELAY CONFIGURATION ON CARD IN FIG. B-14	CARD LOCATIONS IN FIG. B-15*	OUTPUT TERMINAL CONNECTIONS ON ALARM RELAY CARDS
		CARD #	PART NO.			
1 Common Alarm Output Only		1	734C67-7	A	A or B	See Table B-5
8 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	A or B	
	W/O Common Alarm	3	734C67-8	C		
16 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	A or B	
		4	734C67-4	D		
	W/O Common Alarm	3	734C67-8	C	A or B	
		4	734C67-4	D		
24 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	A or B	
		5	734C67-6	E		
	W/O Common Alarm	3	734C67-8	C	A or B	
		5	734C67-6	E		
32 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	A or B	
		5	734C67-6	E		
		6	734C67-4	D		
	W/O Common Alarm	3	734C67-8	C	A or B	
		5	734C67-6	E		
		6	734C67-4	D		
40 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	B	
		5 7	734C67-6	E		
	W/O Common Alarm	3	734C67-8	C	B	
		5 7	734C67-6	E		
48 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	B	
		5 7	734C67-6	E		
		8	734C67-4	D		
	W/O Common Alarm	3	734C67-8	C	B	
		5 7	734C67-6	E		
		8	734C67-4	D		
56 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	B	
		5 7 9	734C67-6	E		
	W/O Common Alarm	3	734C67-8	C	B	
		5 7 9	734C6-6	E		
64 Channel Alarm Outputs	Plus Common Alarm	2	734C67-5	B	B	
		5 7 9	734C67-6	E		
		10	734C67-4	D		
	W/O Common Alarm	3	734C67-8	C	B	
		5 7 9	734C6-6	E		
		10	734C67-4	D		

*Depending on number of channels in system and inclusion of other optional features, alarm relay cards may either be housed on the PD-2064 chassis (view "A" of Fig. B-15) or the expander chassis (view "B" of Fig. B-15).

Table B-5. Channel Alarm Output Connections.

CHANNEL NUMBERS										OUTPUT TERMINAL CONNECTIONS ON ALARM RELAY CARD 36-PIN CONNECTOR	
CARD #1	CARD #2	CARD #3	CARD #4	CARD #5	CARD #6	CARD #7	CARD #8	CARD #9	CARD #10	ALARM RELAY ON CARD	SOLDER PIN CONNECTOR
X	7	7	X	23	X	39	X	55	X	K4	18 V
X	6	6	X	22	X	38	X	54	X	K8	17 U
X	5	5	X	21	X	37	X	53	X	K12	16 T
X	4	4	X	20	X	36	X	52	X	K16	15 S
X	3	3	X	19	X	35	X	51	X	K3	14 R
X	2	2	X	18	X	34	X	50	X	K7	13 P
X	1	1	X	17	X	33	X	49	X	K11	12 N
X	0	0	X	16	X	32	X	48	X	K15	11 M
X	X	X	X	X	X	X	X	X	X	NC	10 L NC
COMMON ALARM	COMMON ALARM	X	15	15	31	31	47	47	63	K2	9 K
X	X	X	14	14	30	30	46	46	62	K6	8 J
X	X	X	13	13	29	29	45	45	61	K10	7 H
X	X	X	12	12	28	28	44	44	60	K14	6 F
X	X	X	11	11	27	27	43	43	59	K1	5 E
X	X	X	10	10	26	26	42	42	58	K5	4 D
X	X	X	9	9	25	25	41	41	57	K9	3 C
X	X	X	8	8	24	24	40	40	56	K13	2 B
X	X	X	X	X	X	X	X	X	X	+5 V / GND	1 +5 V / A GND

CHANNEL ALARM RELAY OUTPUTS TO EXTERNAL CIRCUITS

36-PIN CONNECTOR

NOTES:

X -- Denotes no channel and no corresponding output connections on card connector.
NC = No connection.

■ CAUTION: A +5 V DC potential and ground (GND) are present at terminals 1 and A, respectively, on each card connector. These connection points are provided for factory use only. Do not make external connections to these terminals. To do so may cause damage to internal circuitry.

SECTION C - OPTIONAL SIGNAL INPUTS

C.1 THERMOCOUPLE INPUTS

a. The thermocouple input option employed in the PD-2064 data system enables the acquisition of temperature measurements via a unique and accurate measurement system. The capabilities of the microprocessor are exploited with innovative programming to accomplish thermocouple linearization, scaling, and cold junction compensation. The result is a temperature measurement system of great accuracy, speed, and versatility.

b. The measurement system accommodates inputs from the general class of thermocouple types (i.e., E, J, K, R, S, T); and the temperature ranges covered include the entire temperature spectrum for a particular thermocouple type. The inputs from up to four different thermocouple types may be combined in a single system, and inputs may be arranged in any mixture of channel pairs. For example, a PD-2064 system could be configured to measure 20 Type J, 30 Type K, 50 Type T, and 10 Type R channels--or any other combination. In addition to the thermocouple analog inputs, other analog input actuations and optional digital inputs can be combined in the same system.

C.1.1 LINEARIZATION

a. Thermocouple linearization is accomplished in a ROM with a specific ROM required for each different thermocouple type used. Therefore, a total of up to four thermocouple linearization ROMs can be incorporated in a system. In addition to the specific ROMs used, one other common linearization ROM is used with any of the different thermocouple types.

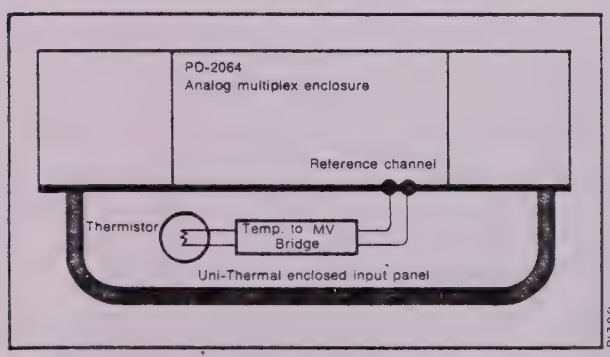


Figure C-1. Thermocouple Input Configuration.

b. The plug-in allocations on the CPU card for the various linearization ROMs are shown in Figure 1-3 of Section 1 in this manual.

C.1.2 MEASUREMENT

a. A thermally-insulated, universal analog input panel located at the rear of the PD-2064 unit and/or the expander package is provided for making signal connections. The thermal input panel is specifically designed for thermocouple inputs, but may also be readily used to connect signals from virtually any other analog input source. Refer to paragraph 2.5.3 in "Installation" section of this manual for procedures in making signal connections.

> NOTE: Universal analog input panel is not designed to accept signal connections from digital input sources when digital input option is included in system.

b. The thermal panel employs a unithermal heat sink and a carefully designed insulated enclosure which maintains an even temperature among all the input terminals. A thermistor senses the panel temperature, converts the measurement to millivolts. and feeds the millivolt signal to the input terminals of the channel number chosen as reference.

> NOTE: For TC reference channel connections, refer to paragraph 2.5.4 in "Installation" section of this manual.

c. The analog reference channel millivolt value is converted to a digital millivolt value which is equivalent to the millivolt value that a specific thermocouple type would measure at the cold junction (input panel). This digitally-converted, equivalent millivolt value is then algebraically added to the digitally-converted, "apparent" millivolt value of each thermocouple input channel being measured at the hot junction. The result from this algebraic addition provides the corrected or true millivolt value being measured at the hot junction of each thermocouple input channel. This corrected millivolt value is then converted to the proper temperature (in degrees) value through a linearization process of the thermocouple's temperature-emf conversion curve.

d. Besides the standard five digits of measurement data which appear in the display on a thermocouple channel, two additional digits of zeroes appear in the MSD and MSD-1 positions as an indication that the channel reading is in a correction function classification (class zero) assigned to thermocouple-actuated measurements. When channel data is outputted to peripheral output devices, only the zero in the MSD-1 position is recorded; the MSD zero is omitted.[1]

Display Example:[2] 00 0033.9 °C

MSD — MSD-1 — 5 DIGITS OF DATA

OPERATIONAL NOTES:

(1) When monitoring individual channel temperature readings via CHAN READ key on keyboard, temperatures displayed are based on the reference channel's temperature correction factor which was derived and stored in memory at the time of the last channel frame scan. To ensure that monitored data is accurate, either a manual or automatic scan should take place periodically so that the reference channel's temperature correction factor will be updated from time to time.

(2) When reference channel is being used for temperature measurements, the channel constants for the reference channel pair (or individual reference channel in single channel programming) should be programmed with the following codes:

I-O code = 1, 2, or 3 (DO NOT program with 0 code. To do so will cause reference channel to be skipped from the scanning operation and will render erroneous temperature measurements due to the absence of the reference channel's temperature correction factor.)

CORR FUNCT code = 0

RANGE code = 1

UNITS code is irrelevant.

---

[1] If channel data is in alarm condition, MSD-1 position is recorded as either a high alarm (:) or low alarm (.) symbol.

[2] If channel reading is in alarm condition, the MSD-1 position will read "A" for "Alarm".

C.1.3 THERMOCOUPLE SPECIFICATIONS

THERMOCOUPLE TYPES AND RANGES:

Chromel-Constantan (Type E)	-240 to +900°C. or -280 to +1800°F.
Iron-Constantan (Type J)	-190 to +750°C. or -310 to +1390°F.
Chromel-Alumel (Type K)	-190 to +1370°C. or -300 to +2490°F.
Platinum-Platinum/13% Rhodium (Type R)	0 to 3210°F.
Platinum-Platinum/10% Rhodium (Type S)	0 to 3090°F.
Copper-Constantan (Type T)	-190 to +390°C. or -310 to +750°F.

DIFFERENT TC TYPES ACCOMMODATED IN SAME SYSTEM . . . . . As many as 4.

COLD JUNCTION COMPENSATION . . . . . Thermal panel containing thermistor and a temperature-to-millivolt conversion circuit; microprocessor mathematically performs digital correction.

LINEARIZATION . . . . . Linearization functions performed by plug-in ROMs. A specific ROM is required for each thermocouple type plus one common ROM for all thermocouple types. Any channel pair (in any order) can be programmed to select any of up to 4 ROMs.

RANGE AND TYPE CHANGE. . . . . A different type thermocouple and range can be accommodated by (1) internal change of a plug-in linearization ROM on the CPU card, and (2) internal change of a gain resistor on the amplifier/A-D converter card.

ACCURACY TABLE

THERMOCOUPLE TYPE	NORMAL OPERATING TEMPERATURE RANGE VERSUS CALIBRATION ACCURACY		INTERMEDIATE RANGE VERSUS ACCURACY		TEMPERATURE RANGE VERSUS WORST CASE ACCURACY		RESOLUTION	COLD JUNCTION ACCURACY**
	RANGE	CALIBRATION ACCURACY*	RANGE	ACCURACY	RANGE	WORST CASE ACCURACY		
Chromel-Constantan (E)	-25 to +1800 °F. -10 to +1000 °C.	±1.2 °F. ±0.8 °C.	-140 to -25 °F. -180 to -10 °C.	±5.5 °F. ±5.5 °C.	-280 to -140 °F. -240 to -180 °C.	+10.5 °F. (@ -220 °) -13 °C. (@ -220 °)	0.1°	±0.025 °/°
Iron-Constantan (J)	-190 to +1390 °F. -110 to +750 °C.	±1.2 °F. ±0.8 °C.	-215 to -190 °F. None	±5 °F. None	-310 to -215 °F. -190 to -110 °C.	-8 °F. (@ -275 °) -3 °C. (@ -135 °)		
Chromel-Alumel (K)	-35 to +2490 °F. -40 to +1370 °C.	±1.5 °F. ±1 °C.	-180 to -35 °F. -110 to -40 °C.	±3 °F. ±4 °C.	-300 to -180 °F. -190 to -110 °C.	-7 °F. (@ -230 °) -6 °C. (@ -140 °)		
Platinum-Platinum/ 13% Rhodium (R)	+350 to +3210 °F.	±3.5 °F.	+225 to +350 °F.	±10 °F.	0 to +225 °F.	-19 °F. (@ +100 °)		
Platinum-Platinum/ 10% Rhodium (S)	+260 to +3090 °F.	±2.5 °F.	+200 to +260 °F.	±8 °F.	0 to +200 °F.	-16 °F. (@ +140 °)		
Copper-Constantan (T)	-150 to +750 °F. -160 to +390 °C.	±0.9 °F. ±0.8 °C.	-210 to -150 °F. -180 to -160 °C.	±1.5 °F. ±1.5 °C.	-310 to -210 °F. -190 to -180 °C.	-2.5 °F. (@ -245 °) -2.5 °C. (@ -190 °)		

* Calibration accuracy is defined as guaranteed accuracy of reading under test conditions of 75 °F. (±5 °F.) ambient temperature, 0-70% relative humidity, and line voltage @ 120V AC ±10%. This specification includes curve conformity error, but does not include cold junction compensation errors which are listed separately in accuracy table.

** The cold junction accuracy covers error effects due to changes in ambient temperature of the thermocouple input panel. For example, a 10 °F. change in ambient temperature may cause up to a 0.25 °F. measurement error.

C.2 DIGITAL (BCD) INPUT

a. The digital input option employed in the PD-2064 data system permits acquisition of digital data from such input sources as digital counters, digital voltmeters, digital output transducers (encoders), and other similar devices.

b. A total of 16 different digital input devices, each with up to 7 digits of BCD (binary coded decimal) data may be configured into the channel input selection system. Scanning of the digital channels is performed immediately after the scanning of all specified analog channels. Both analog and digital data are stored in memory and then outputted to proper output device(s) in accordance with the programmed input-output (I-O) code for each channel pair. The output device(s) receives the analog data first, and then the data from digital channels.

c. Depending on the system input requirements, digital input mux cards may be housed in the auxiliary card cage at the rear of the PD-2064 unit, or housed in an external expander package. Since the input system can accommodate a total of 16 digital channels, as many as 8 of the 16 mux cards (1 channel per mux card) may be housed in the internal auxiliary card cage with as many as 8 more mux cards housed in an external expander package. In addition to the digital input mux cards, an internally-mounted digital input control card is also required for the digital input option. The plug-in locations of the mux card(s) and control card on the PD-2064 chassis are shown in Figure 1-2 of Section 1 in this manual.

C.2.1 DIGITAL INPUT CONNECTIONS

For procedures in making digital input connections, refer to paragraph 2.5.5 in "Installation" section of this manual.

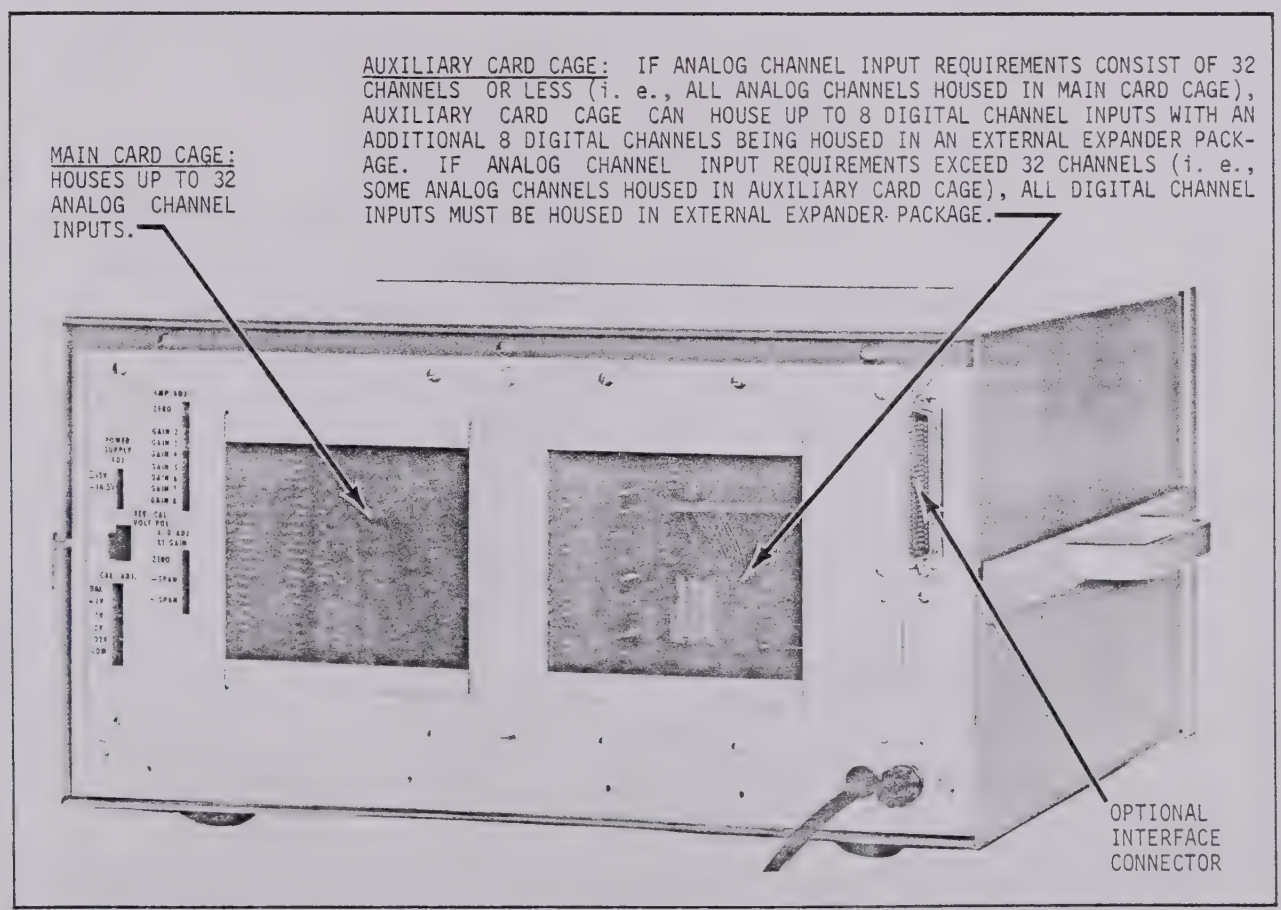

AUXILIARY CARD CAGE: IF ANALOG CHANNEL INPUT REQUIREMENTS CONSIST OF 32 CHANNELS OR LESS (i. e., ALL ANALOG CHANNELS HOUSED IN MAIN CARD CAGE), AUXILIARY CARD CAGE CAN HOUSE UP TO 8 DIGITAL CHANNEL INPUTS WITH AN ADDITIONAL 8 DIGITAL CHANNELS BEING HOUSED IN AN EXTERNAL EXPANDER PACKAGE. IF ANALOG CHANNEL INPUT REQUIREMENTS EXCEED 32 CHANNELS (i. e., SOME ANALOG CHANNELS HOUSED IN AUXILIARY CARD CAGE), ALL DIGITAL CHANNEL INPUTS MUST BE HOUSED IN EXTERNAL EXPANDER PACKAGE.
MAIN CARD CAGE: HOUSES UP TO 32 ANALOG CHANNEL INPUTS.
OPTIONAL INTERFACE CONNECTOR
P1402

Figure C-2. Channel Input Configurations at Rear of PD-2064.

C.2.2 DIGITAL INPUT SPECIFICATIONS[1]

Number of Inputs: 16 maximum, 8 per card cage (Note that for every digital channel used, maximum number of analog channels accommodated in system decreases by one).

Configuration: One input channel per digital mux card.

Logic Levels: Standard TTL levels: Logic 1 = 4.5 to 5.5V DC; logic 0 = 0 to 0.5V DC; complementary logic is selectable via connection of external jumper. (CAUTION: Strict adherence to specified logic levels must be maintained to avoid damage to instrument).

SIGNAL CONFIGURATION PER CHANNEL[2]

Input Signals: May consist of 7 digits of BCD numeric data plus 1 digit for data control [i.e., $\overline{\text{COMP}}$(OUT), $\overline{\text{COMP}}$(IN), DELAY, $\overline{\text{READY}}$];or the total of 7 input digits may be divided into 5 digits of BCD numeric data, plus 1 digit for the sign data, plus 1 digit for condition of data (i.e., normal data, overrange, low alarm, high alarm, or default), plus the digit for data control.

Output Signals: Consist of logic levels for UNITS CODE, RANGE CODE, READ and CHAN PULSE signals.

Sequence of Instructions for Standard Digital Input Program:

(1) $\overline{\text{COMP}}$(OUT) logic signal sent from digital source to PD-2064. Controls the logic sense of all PD-2064 output signals except READ signal. Logic sense can be selected by connection of external jumper.

(2) Programmed UNITS CODE and RANGE CODE logic signals for selected channel pairs sent from PD-2064 to digital source.

(3) DELAY logic signal sent from digital source to PD-2064.

(4) After approximately 94mS time delay generated by PD-2064, READ logic signal sent from PD-2064 to digital source.

(5) Digital source takes reading and then sends $\overline{\text{READY}}$ logic signal to PD-2064.

NOTE: If PD-2064 does not receive the $\overline{\text{READY}}$ signal from digital source for a particular channel, the PD-2064 will output the minus (-) code for all digits of that channel when a channel data frame is outputted. If data from digital source will always be ready, tie pin U on digital mux card connector to digital ground.

(6) $\overline{\text{COMP}}$(IN) logic signal sent from digital source to PD-2064. Controls the logic sense of all PD-2064 BCD numeric input data, but not the 4 control lines. Logic sense can be selected by connection of external jumper.

(7) BCD numeric data and other data condition information (sign, overrange, high alarm, low alarm, default) sent from digital source to PD-2064.

[1] Specifications given are for the standard digital input program. Other customized digital input programs are available as an option. Consult factory.

[2] See Signal Connection Table 2.2 in "Installation" section of this manual. If digital mux card for a particular channel is missing or unplugged, a blank code will be outputted for all digits of that channel.

C.2.3 OPERATIONAL ASPECTS OF DIGITAL INPUT PROGRAM

a. The standard digital input program is designed to provide for full handshaking capability between the digital input source and the PD-2064 instrument; however, the digital input/output signal connections may also be made to operate without the normal handshaking process. For typical signal connections, refer to Figure C-2.2. For timing diagram of signals, refer to Figure C-2.1.

b. Only one ROM is required for the digital input control program. This ROM is located in ROM 15 position on the CPU card. For location of CPU card and ROM 15 position on CPU card, refer to Figures 1-2 and 1-3, respectively, in Section 1 of manual.

c. Each digital channel input may consist of either: (1) five digits of BCD numeric data plus a sixth digit for the polarity sign indication and an additional seventh digit for the condition of the data (i.e.--normal data, overrange, low alarm, high alarm, or default) or (2) seven digits of BCD numeric data.

d. When the digital inputs consist of seven digits of BCD numeric data, the polarity sign digit (digit 6) and the data condition digit (digit 7) will not be treated as valid numeric data if the "Alarms" program or other correction functions are incorporated in the PD-2064. See below.

DIGIT POSITION	BCD CODE	DIGITAL CODE (HEX.)	PD-2064 OUTPUT DATA	
			Display	"Seiko" Printout
6 (Polarity Sign):				
Plus (+)	1111	F	Blank	Blank
Minus (-)	1010	A	-	-
7 (Data Condition):				
Normal Data	1111	F	Blank	Blank
Overrange	1110	E	L	#
Low Alarm	1011	B	.	.
High Alarm	1100	C	A	:
Default	1101	D	'	Sh

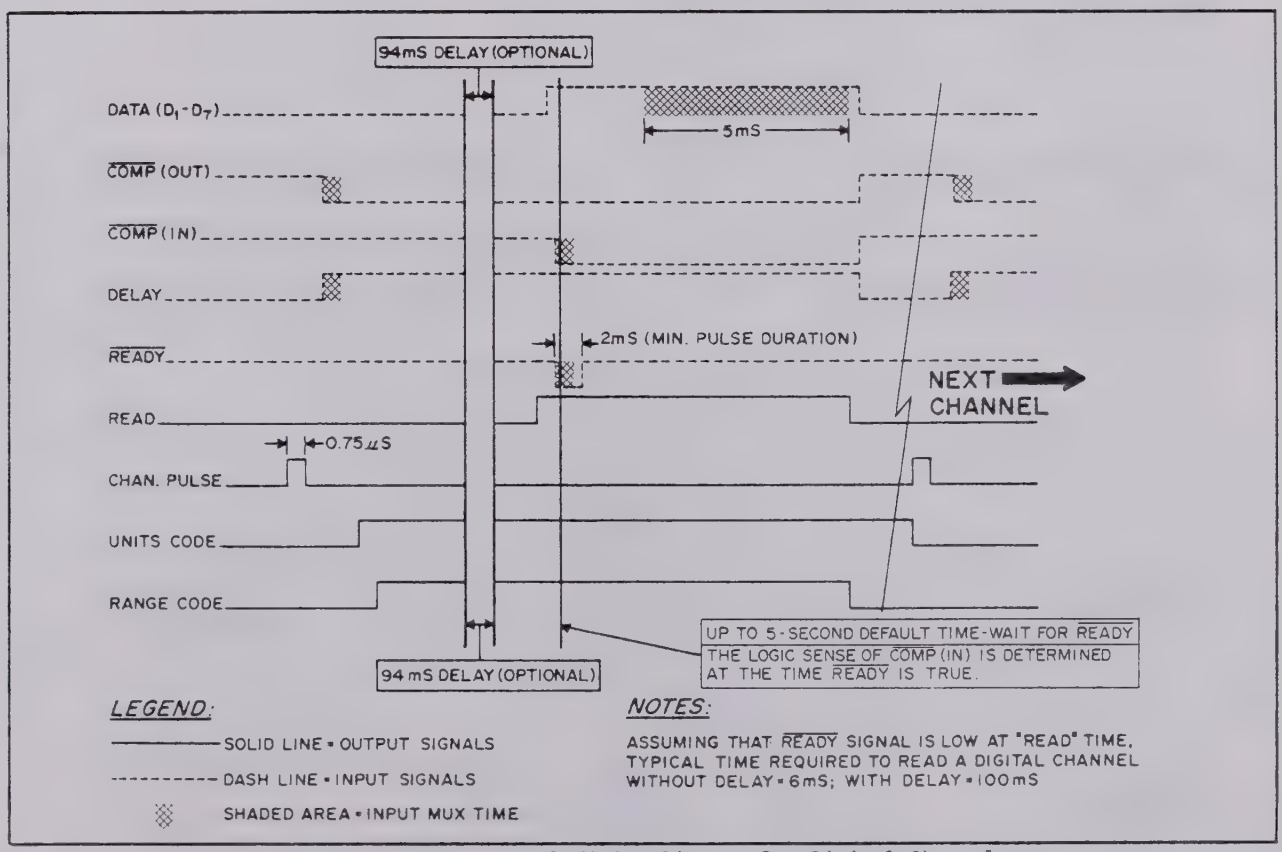

94mS DELAY (OPTIONAL)
DATA (D_1-D_7)
5mS
COMP (OUT)
COMP (IN)
DELAY
2mS (MIN. PULSE DURATION)
READY
NEXT CHANNEL
READ
0.75μS
CHAN. PULSE
UNITS CODE
RANGE CODE
UP TO 5-SECOND DEFAULT TIME-WAIT FOR READY
THE LOGIC SENSE OF COMP (IN) IS DETERMINED AT THE TIME READY IS TRUE.
94 mS DELAY (OPTIONAL)
LEGEND:
SOLID LINE = OUTPUT SIGNALS
DASH LINE = INPUT SIGNALS
SHADED AREA = INPUT MUX TIME
NOTES:
ASSUMING THAT READY SIGNAL IS LOW AT "READ" TIME, TYPICAL TIME REQUIRED TO READ A DIGITAL CHANNEL WITHOUT DELAY = 6mS; WITH DELAY = 100mS
P1542

Figure C-2.1. Typical Timing Diagram Per Digital Channel.

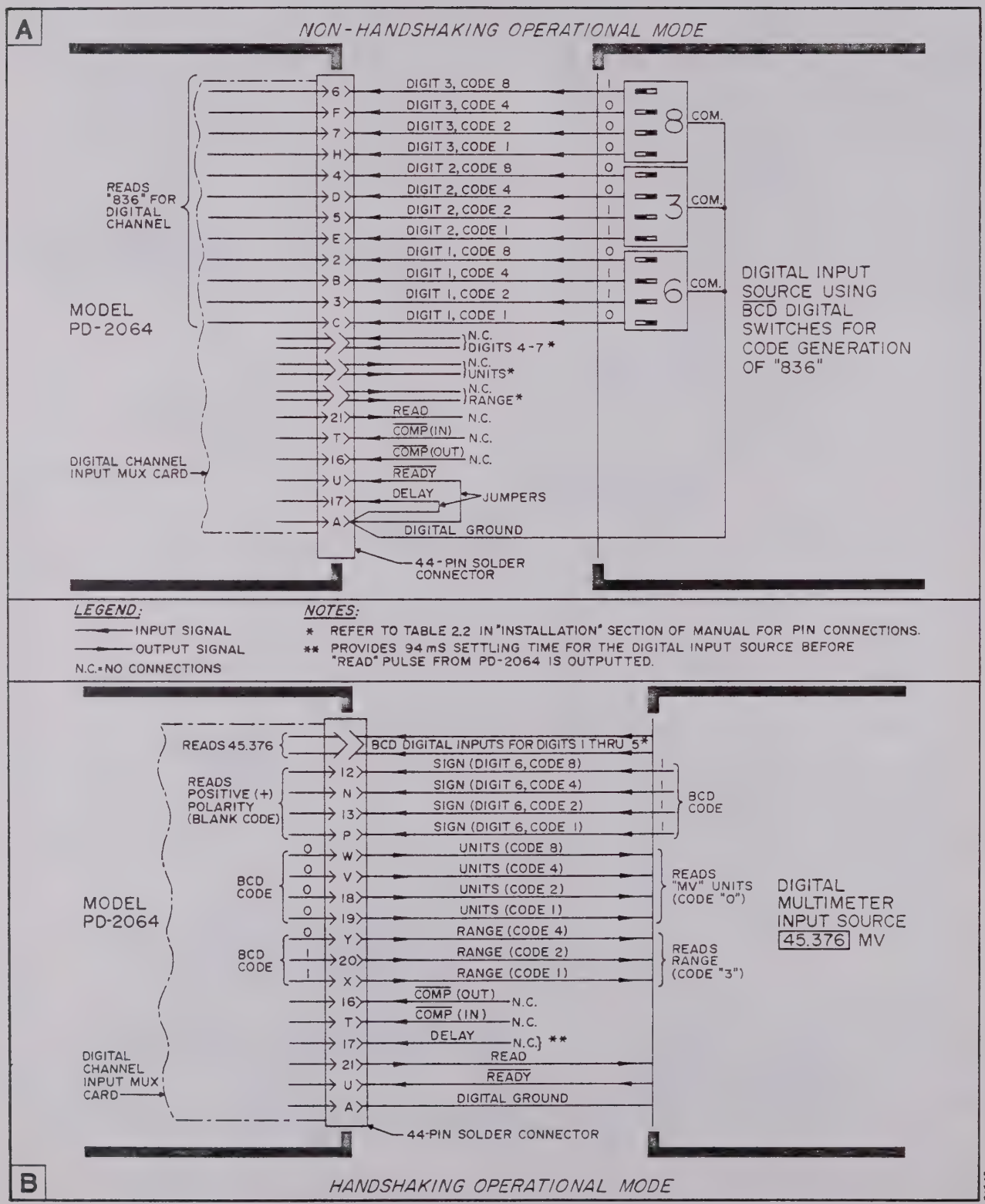


Figure C-2.2. Typical Digital Input Connection Diagrams Per Channel Basis.

C.2.3.1 FUNCTIONS OF SIGNAL LINES FOR STANDARD OPERATION [1]

	SIGNAL NAME	FUNCTION
INPUT SIGNAL LINES	Digits 1 Thru 7	Reads BCD or $\overline{\text{BCD}}$ data into PD-2064 data system memory. A typical data printout for channel 6 on the "Seiko" printer would appear as Ch006 $-D_5D_4.D_3D_2D_1$ MV The minus polarity sign (-) is represented by a 10 code (1010) in BCD and a 5 code (0101) in $\overline{\text{BCD}}$. The positive polarity sign (+) is implied and is represented by a blank, 15 code (1111) in BCD and a zero code (0000) in $\overline{\text{BCD}}$.
	$\overline{\text{Comp}}$ (Out)	Connecting this line low causes the range and units codes to be outputted in $\overline{\text{BCD}}$. Leaving this line open will cause outputting of range and units codes in BCD.
	$\overline{\text{Comp}}$ (In)	Connecting this line low causes $\overline{\text{BCD}}$ input coding on the input lines for digits 1 thru 7. Leaving this line open selects BCD coding of the digit input lines.
	Delay	A high on this line provides a 94mS settling time for the digital input source before the "Read" pulse from PD-2064 is outputted. Connecting this line low defeats the delay.
	$\overline{\text{Ready}}$	A low on this line tells the PD-2064 that data from digital source is ready (valid). This line must be pulled low within 4 seconds following the "Read" pulse. Failure of the digital source to supply the $\overline{\text{Ready}}$ signal will cause the PD-2064 to output the minus (-) code for all digits of that channel when the channel data frame is outputted. This line can be tied low if the data from the digital source will always be ready.
OUTPUT SIGNAL LINES [2]	Units	Outputs the current BCD units code for the channel. If $\overline{\text{Comp}}$ (Out) signal line is open, units code will be outputted in BCD. If $\overline{\text{Comp}}$ (Out) signal is tied low, units code will be outputted in $\overline{\text{BCD}}$.
	Range	Outputs the 3 least significant bits of the range code (codes 1, 2, and 4). The range code determines the decimal point location in the outputted data. If $\overline{\text{Comp}}$ (Out) signal line is open, range code will be outputted in BCD. If $\overline{\text{Comp}}$ (Out) signal is tied low, range code will be outputted in $\overline{\text{BCD}}$.
	Read	This line is set low by the PD-2064 when it is ready to read the data. The "Read" signal is set high prior to checking for the $\overline{\text{Ready}}$ signal from the digital source.
Channel Pulse		This 0.75uS strobe pulse is available from the PD-2064 to indicate that the data system is preparing to read a digital channel. Total loading for all channels is limited to 1 TTL unit load capacity. Capacitance must not exceed 5pF.
+5V		Approximately 100 mA (total for all digital channels) is available for pull-up potential.
Digital Ground		Connects to PD-2064 logic ground.

[1] Refer to Table 2.2 in "Installation" section of manual for signal line connections.

[2] All output signals are capable of driving 1 TTL unit load per channel.

C.2.3.2 REPRESENTATION OF DIGITAL DATA

DIGITAL DATA INPUTTED		DIGITAL DATA OUTPUTTED	
BCD Code[1]	Digital Code[2] (Hexidecimal)	Display[3]	"Seiko" Printout[4]
0000(1111)	0(F)	0 (Blank)	0 (Blank)
0001(1110)	1(E)	1 (L)	1 (*)
0010(1101)	2(D)	2 (')	2 (Ch)
0011(1100)	3(C)	3 (A)	3 (:)
0100(1011)	4(B)	4 (.)	4 (.)
0101(1010)	5(A)	5 (-)	5 (-)
0110(1001)	6(9)	6 (9)	6 (9)
0111(1000)	7(8)	7 (8)	7 (8)
1000(0111)	8(7)	8 (7)	8 (7)
1001(0110)	9(6)	9 (6)	9 (6)
1010(0101)	A(5)	- (5)	- (5)
1011(0100)	B(4)	. (4)	. (4)
1100(0011)	C(3)	A (3)	: (3)
1101(0010)	D(2)	' (2)	Ch (2)
1110(0001)	E(1)	L (1)	* (1)
1111(0000)	F(0)	Blank (0)	Blank (0)

[1] $\overline{\text{BCD}}$ complementary code is shown in parenthesis. $\overline{\text{BCD}}$ code is selected by connecting $\overline{\text{COMP}}$ (In) signal low.

[2] Digital code shown in parenthesis corresponds to the $\overline{\text{BCD}}$ complementary code.

[3] Display shown in parenthesis corresponds to the $\overline{\text{BCD}}$ complementary code.

[4] Printout shown in parenthesis corresponds to the $\overline{\text{BCD}}$ complementary code.

C.2 DIGITAL (BCD) INPUT

a. The digital input option employed in the PD-2064 data system permits acquisition of digital data from such input sources as digital counters, digital voltmeters, digital output transducers (encoders), and other similar devices.

b. A total of 16 different digital input devices, each with up to 7 digits of BCD (binary coded decimal) data may be configured into the channel input selection system. Scanning of the digital channels is performed immediately after the scanning of all specified analog channels. Both analog and digital data are stored in memory and then outputted to proper output device(s) in accordance with the programmed input-output (I-O) code for each channel pair. The output device(s) receives the analog data first, and then the data from digital channels.

c. Depending on the system input requirements, digital input mux cards may be housed in the auxiliary card cage at the rear of the PD-2064 unit, or housed in an external expander package. Since the input system can accommodate a total of 16 digital channels, as many as 8 of the 16 mux cards (1 channel per mux card) may be housed in the internal auxiliary card cage with as many as 8 more mux cards housed in an external expander package. In addition to the digital input mux cards, an internally-mounted digital input control card is also required for the digital input option. The plug-in locations of the mux card(s) and control card on the PD-2064 chassis are shown in Figure 1-2 of Section 1 in this manual.

C.2.1 DIGITAL INPUT CONNECTIONS

For procedures in making digital input connections, refer to paragraph 2.5.5 in "Installation" section of this manual.

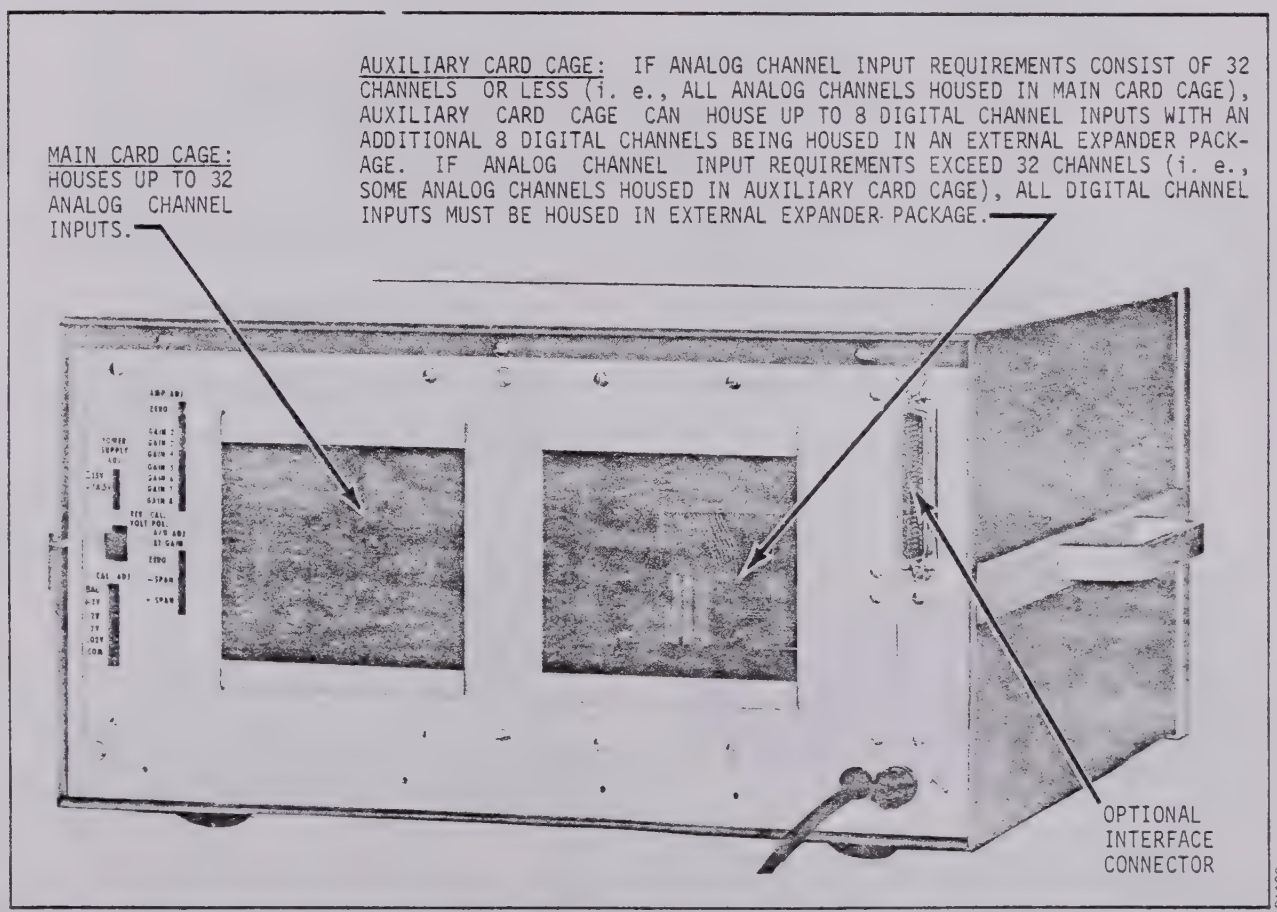

MAIN CARD CAGE: HOUSES UP TO 32 ANALOG CHANNEL INPUTS.
AUXILIARY CARD CAGE: IF ANALOG CHANNEL INPUT REQUIREMENTS CONSIST OF 32 CHANNELS OR LESS (i. e., ALL ANALOG CHANNELS HOUSED IN MAIN CARD CAGE), AUXILIARY CARD CAGE CAN HOUSE UP TO 8 DIGITAL CHANNEL INPUTS WITH AN ADDITIONAL 8 DIGITAL CHANNELS BEING HOUSED IN AN EXTERNAL EXPANDER PACKAGE. IF ANALOG CHANNEL INPUT REQUIREMENTS EXCEED 32 CHANNELS (i. e., SOME ANALOG CHANNELS HOUSED IN AUXILIARY CARD CAGE), ALL DIGITAL CHANNEL INPUTS MUST BE HOUSED IN EXTERNAL EXPANDER PACKAGE.
OPTIONAL INTERFACE CONNECTOR
P1402

Figure C-2. Channel Input Configurations at Rear of PD-2064.

C.2.2 DIGITAL INPUT SPECIFICATIONS[1]

Number of Inputs: 16 maximum, 8 per card cage (Note that for every digital channel used, maximum number of analog channels accommodated in system decreases by one).

Configuration: One input channel per digital mux card.

Logic Levels: Standard TTL levels: Logic 1 = 4.5 to 5.5V DC; logic 0 = 0 to 0.5V DC; complementary logic is selectable via connection of external jumper. (CAUTION: Strict adherence to specified logic levels must be maintained to avoid damage to instrument).

SIGNAL CONFIGURATION PER CHANNEL[2]

Input Signals: May consist of 7 digits of BCD numeric data plus 1 digit for data control [i.e., $\overline{\text{COMP}}$(OUT), $\overline{\text{COMP}}$(IN), $\overline{\text{DELAY}}$, $\overline{\text{READY}}$];or the total of 7 input digits may be divided into 5 digits of BCD numeric data, plus 1 digit for the sign data, plus 1 digit for condition of data (i.e., normal data, overrange, low alarm, high alarm, or default), plus the digit for data control.

Output Signals: Consist of logic levels for UNITS CODE, RANGE CODE, and $\overline{\text{READ}}$ signals.

Test Signals: Consist of CHAN PULSE and +5V. These 2 logic signals are provided for factory use only and are not required or intended for use in the operation of the standard digital input program.

Sequence of Instructions for Standard Digital Input Program:

(1) $\overline{\text{COMP}}$(OUT) logic signal sent from digital source to PD-2064. Controls the logic sense of all PD-2064 output signals except READ signal. Logic sense can be selected by connection of external jumper.

(2) Programmed UNITS CODE and RANGE CODE logic signals for selected channel pairs sent from PD-2064 to digital source.

(3) $\overline{\text{DELAY}}$ logic signal sent from digital source to PD-2064.

(4) After approximately 85ms time delay generated by PD-2064, READ logic signal sent from PD-2064 to digital source.

(5) Digital source takes reading and then sends $\overline{\text{READY}}$ logic signal to PD-2064.

NOTE: If PD-2064 does not receive the $\overline{\text{READY}}$ signal from digital source for a particular channel, the PD-2064 will output the minus (-) code for all digits of that channel when a channel data frame is outputted. If data from digital source will always be ready, tie pin U on digital mux card connector to digital ground.

(6) $\overline{\text{COMP}}$(IN) logic signal sent from digital source to PD-2064. Controls the logic sense of all PD-2064 BCD numeric input data, but not the 4 control lines. Logic sense can be selected by connection of external jumper.

(7) BCD numeric data and other data condition information (sign, overrange, high alarm, low alarm, default) sent from digital source to PD-2064.

[1] Specifications given are for the standard digital input program. Other customized digital input programs are available as an option. Consult factory.

[2] See Signal Connection Table 2.2 in "Installation" section of this manual. If digital mux card for a particular channel is missing or unplugged, a blank code will be outputted for all digits of that channel.

C.3 INTEGRATOR

C.3.1 GENERAL

a. Use of the integrator option with the Model PD-2064 key-programmable data system permits the measuring and recording of data values that represent the time integration of a variety of analog input values, rather than the instantaneous analog values as normally recorded by the PD-2064.

b. As illustrated in Figure C-3, the integration circuit for each analog channel input totalizes areas under the variable/time curve for time periods between data scans and stores the accumulation in memory. Division of the accumulated total by the duration of a pre-selected time period yields the average value.

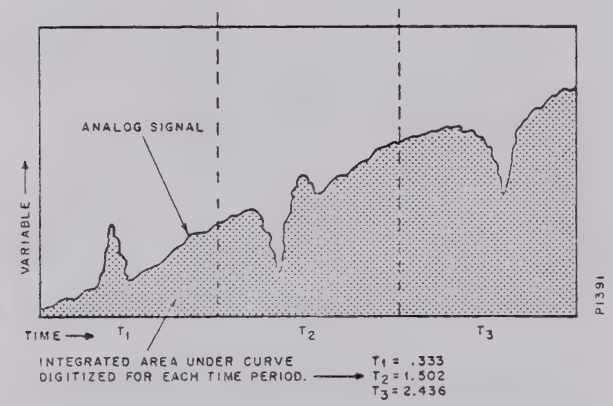


Figure C-3. Hypothetical Analog Curve.

C.3.2 SYSTEM CONFIGURATION

a. The integrator system consists of the basic PD-2064 instrument and one or more separately housed integrator units (Figure C-4) which are interconnected through control cabling to provide systematic control of integrated operations. Each integrator unit accepts up to 10 analog channel inputs (expandable from 1-10 channels per unit).

b. The analog-channel signals desired to be integrated are connected to input terminals at the rear of each integrator card installed in the integrator unit (see Figure C-5). Instantaneous analog-channel signals that are not to be integrated are connected to the analog input mux cards at the rear of the PD-2064 in the normal manner.

c. The output terminals on each integrator card, in turn, connects each channel's integrated analog signal to the appropriate input terminals on the analog input mux cards at the rear of the PD-2064. The integrated analog signal inputs to the PD-2064 are scanned, measured, digitized, stored, and then fed to the output device(s) interfaced to the PD-2064.

d. The integrator uses a continuous analog integration circuit with digital switching control provided by the PD-2064. The integrated area (totalized) value output of the integrator is scaled (via internal voltage dividers) to provide an average value of the input for a single, pre-selected time period. This method of continuous integration permits an average reading to be taken on one channel while an instantaneous value of the same signal input can be taken on an adjacent channel. By this means, a signal's instantaneous and average value can be easily compared.

> NOTE: If a non-continuous, true average of analog and/or optional digital inputs is desired (integrator not required), optional custom program ROMs are available whereby input signals are averaged for up to 99 successive readings on any channels of the PD-2064.

e. Timing and control signals governing the operation of the integrator are derived from the PD-2064 with integration time periods being programmed via the "Scan Interval" key setting. Integration time should not exceed one hour to comply with accuracy specifications of the integrated circuit; however, longer integration times can be optionally furnished by special summing programs through the PD-2064 microprocessor.



Figure C-4. Integrator Unit.

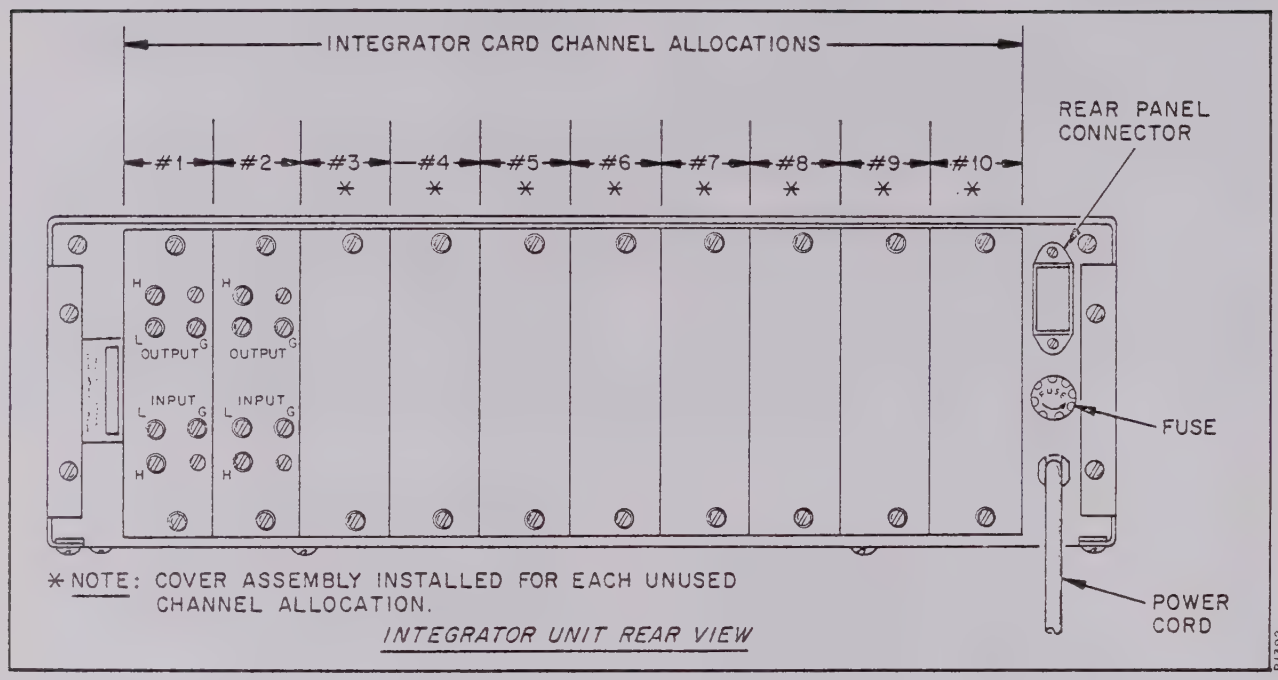


Figure C-5. Channel Allocations.

EXAMPLE: Assume a 24-hour integration period is desired. A special correction function could be programmed into the PD-2064 to calculate 24 successive, 1-hour readings with only one output recorded for the day. Channel pairs may be programmed in this manner with instantaneous readings and short-duration integration values being recorded on adjacent channels.

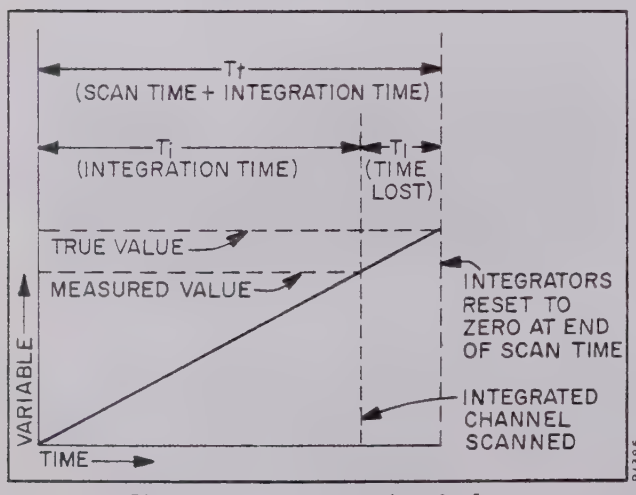


Figure C-6. Integration Cycle.

f. When considering the number of integration channels employed in a system, cycle time must be taken into account. The total elapsed time for an integration cycle (as programmed by the "Scan Interval" key) consists of the desired integration time period plus the inherent time required to scan all channels in the system. For "Scan Rate" specifications, refer to paragraph A.3 in "Section A" of Appendix.

NOTE: When integrator option is incorporated in system, the channel interval time (as programmed by "Channel Interval" key) should be set to zero so that the portion of integration cycle time attributable to scan time is kept at minimum (fastest scan rate).

g. Since the scan time and integration time are cumulative to comprise the total integration cycle time, the actual time attributable to the integration period is reduced by a "time lost" factor (Figure C-6) and can be expressed by the following equations:

(1) $T_i = T_t - T_l$

(2) T_l = [Number of channels left in channel frame scan after each channel of integration] ÷ [scan rate].

(3) $T_e = T_l \div T_t$

where: T_i = Actual time period of integration.

T_t = Total time period of integration cycle (set by "Scan Interval" key).

T_l = Time lost (portion of integration time that is lost).

T_e = Time loss error as percentage of total integration time period.

h. A typical example in figuring the "time lost" factor in a system with the integrator option is given as follows:

Given: System consists of 64 analog channels with 10 of the 64 channels being integrated.

Five channels of integration are connected to channels 8 through 12, and the five remaining channels of integration are connected to channels 56 through 60. Using equations #1, #2, and #3 and assuming a scan rate of 10 channels/second and an integration cycle period of 5 minutes (T_t), Table C-1 tabulated data can be derived.

i. As observed from tabulated data of example, optimum requirements to meet accuracy specifications are (1) to keep T_l to a minimum so that T_i is virtually equal to T_t, and/or (2) to use longer integration time periods (up to 1 hour) wherever possible. Minimizing the "time lost" (T_l) factor is done by connecting channels to be integrated to channel allocations near the end of the channel frame scan. Another method of compensating for the "time lost" (T_l) factor is to set the integration cycle period to a time that is equal to the desired time plus the "time lost" factor (i.e., $T_t = T_i + T_l$).

Table C-1. Integration "Time Lost" Factors.[1]

Integrated Ch. No.	Number of Channels Left in Frame Scan After Each Channel of Integration	T_l	T_i T_t=300 sec. (5 min.)	T_e	
Ch. 8	55	5.5 sec.	294.5 sec.	1.83%	
Ch. 9	54	5.4 sec.	294.6 sec.	1.80%	Excessive Error
Ch. 10	53	5.3 sec.	294.7 sec.	1.76%	
Ch. 11	52	5.2 sec.	294.8 sec.	1.73%	
Ch. 12	51	5.1 sec.	294.9 sec.	1.70%	
Ch. 56	7	.7 sec.	299.3 sec.	.23%	
Ch. 57	6	.6 sec.	299.4 sec.	.20%	Within Accuracy Requirements
Ch. 58	5	.5 sec.	299.5 sec.	.16%	
Ch. 59	4	.4 sec.	299.6 sec.	.13%	
Ch. 60	3	.3 sec.	299.7 sec.	.10%	

[1] Tabulated data obtained from example given in paragraph h above.

C.3.3 INTEGRATOR SPECIFICATIONS

Measurement Method: Continuous analog integration.

Channel Density: Up to 10 channels per integrator unit. Individual channel integrator cards plug in from rear of unit.

Channel Isolation: Electrical isolation provided through use of separate power supplies for each integration channel.

Input Impedance: 10 megohms minimum without input voltage divider; 50K to 100K with input divider. Greater than 100,000 megohms with input preamp.

Maximum Input Signal: Instantaneous peak value applied between H and L input terminals should not exceed ±10V DC without an input voltage divider. If voltage divider is used, peak value should not exceed ±10V DC times the voltage divider ratio.

Input Range: 0 to ±100mV DC is standard (higher-level inputs with internal voltage dividers; 0 to ±50mV DC with internal preamp circuitry).

Output Signal: Output signal is proportional to integration time and value of input signal. Standard output signal equals 0 to ±10V DC maximum at rated input signal levels for 1 hour integration period. Output signal may be scaled (via internal output voltage dividers on each output channel) so that a predetermined output less than ±10V DC may be obtained for a single, predetermined integration time at the rated input signal level.

Output Impedance: 2K maximum.

Saturation Output Voltage: ±12V DC at output of integrator divided by output voltage divider ratio (if used) at rated accuracy.

Saturation Time: That time required to produce saturation output voltage at the rated input voltage.

Integration Time Periods: Programmable by "Scan Interval" setting on PD2064. One hour maximum time period for specified accuracy. Longer time periods available as option (consult factory). Time period selected is common to all channels being integrated.

Accuracy (Over Operating Temperature Range of 0 - 60°C.):

±1% of full-scale output for a full-scale input signal of ±100mV at an integration time of 1 hour.

±3% of full-scale output for average input signal levels less than one-tenth of rated values.

NOTE: See accuracy contingencies described in paragraphs g, h, and i under section C.3.2. Also, to avoid saturation effects on accuracy specifications, strict adherence to pre-selected integration times and rated input signal levels must be maintained.

Common Mode Rejection: 100 db minimum AC or DC.

Common Mode Voltage: ±200V DC or 125V RMS AC.

Power Requirements: 100/120/200/240V AC, ±10%, 50/60 Hz; 2 VA per channel.

Size: H = 5¼" (133mm); W = 17" (432mm); D = 17¼" (438mm); bench or rack mount.

Operational Mode Option: Scan and output all channels at one frame rate; reset integrators at another rate (multiple of basic scan rate).

C.3.4 'INTEGRATOR DUAL-RATE' OPTION

C.3.4.1 GENERAL

This option permits programmable selection of a timed relationship between the rate at which the scans of integration are made and the rate at which the integrators are reset.

> NOTE: This option is operational in either the "Input" or "Automatic" mode of system operation.

C.3.4.2 ROM REQUIREMENTS

a. The components required for the "integrator dual-rate" option consist of plug-in ROMs 7 and 10 which are located on the CPU card.

> NOTE: For location of CPU card and ROM positions on CPU card, refer to Figures 1-2 and 1-3, respectively, in Section 1 of manual.

b. ROM 7 functions as the "custom read control" program and is identified by E.A. part number ROM130207002. ROM 10 functions as the "integrator dual-rate control" program and is identified by E.A. part number ROM130210007.

C.3.4.3 PROGRAMMING

a. This option is programmed into the system operation via the 4-digit, channel frame identification number. The ID number is programmed by the ID key and appropriate numerical entry from the keyboard.

b. The programmable ID number consists of a 4-digit number. The control functions of the number are subdivided into two, 2-digit numbers as illustrated in Figure C-7.

C.3.4.3.1 ID LEAST SIGNIFICANT DIGITS

a. The two least significant digits of the ID number (LSD and LSD-1) control the ratio of the scan and reset rates. This segment of the ID number sets the number of scans ("N") that are to be made at the programmed scan interval rate before the integrators are permitted to be reset. In this manner, integrators are reset for every "N" number of scans, or as expressed in the following equation:

"N" number of scans at programmed scan interval rate (maximum "N"=99) } = one resetting of integrators

b. For example, with a programmed scan interval rate of 6 minutes, a number of 10 set in the least significant digits causes 9 scans at 6-minute intervals to be outputted. After 10th scan is outputted 6 minutes later, integrators are reset.

c. In the example cited above, a dual-rate ratio of 1:10 is established between the reset and scan rates. That is, 1 scan is made every 6 minutes and the integrators are reset every 60 minutes (10 scans X 6 minutes) to provide the ratio of 1:10. This dual-rate relationship may be expressed by the following equation:

$$\frac{\text{one scan every 6 minutes}}{\text{one reset every 60 minutes}} = \text{reset/scan ratio of 1/10 or 1:10; that is, integrators reset after 10 scans have been made.}$$

d. The number of scans (as programmed by the two LSD's of the ID number) multiplied by the scan interval rate is equivalent to the total integration time period (reset rate). This total integration cycle time should not exceed one hour in duration for specified accuracy (see "Specifications" in C.3.3). Expressed as an equation:

("N") X ("Scan Interval Rate") = I_T = Reset Rate

Where:

"N" = number of scans

"Scan Interval Rate" = Repetition rate in minutes and/or seconds at which scans are made. Set by SCAN INTVL key.

I_T = Total time period of integration cycle (maximum time period allowable is one hour for specified accuracy). Therefore, the product of "N" and the "Scan Interval Rate" should not exceed the one hour specification.

C.3.4.3.2 ID MOST SIGNIFICANT DIGITS

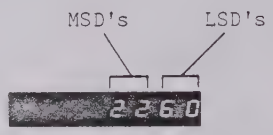
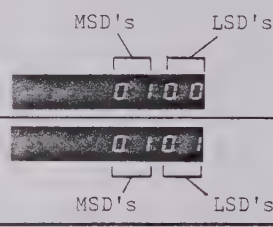
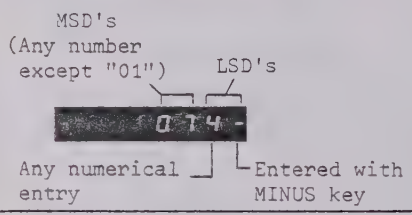
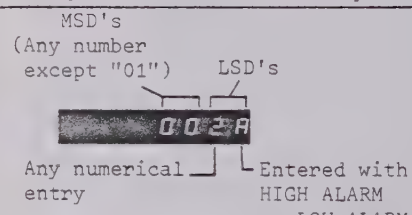
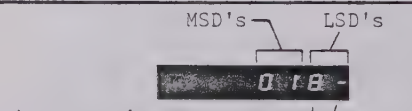
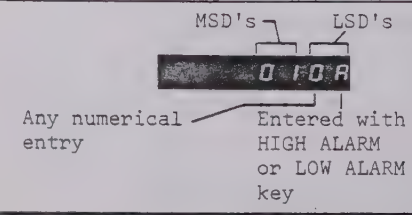
a. The two most significant digits of the ID number (MSD and MSD-1) automatically keep count of the number of scans that have been integrated. Whenever the most significant digits become equal to the least significant digits, the most significant digits are automatically reset to "01" at the next scan interval time.

b. When the count of "01" occurs, the integrators are reset to zero. After the most significant digits are reset to "01", counting cycle continues to repeat itself--beginning at the "01" count and ending at the count which has been set for the least significant digits. When initially programming the ID number, the two most significant digits are normally set to "00".

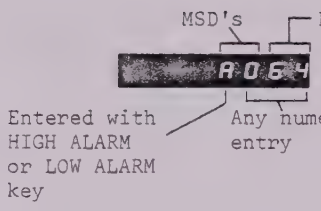
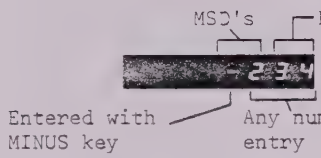
C.3.4.4 OPERATIONAL ASPECTS

Various operational aspects of a system employing the "integrator dual-rate" option are affected depending on how the ID number has been programmed. These are summarized in the following table.

Operational Aspects

EXAMPLES OF PROGRAMMED ID NUMBERS	OPERATIONAL MODE
	Normal integrator dual-rate operation. With ID initially programmed at "0060", the two most significant digits of the ID number currently indicate that "22" scans have been integrated. The two least significant digits of the ID number indicate that "60" scans are to be integrated before integrators are reset. The most significant digits are reset to "01" after time of 60th scan to cause integrators to reset. With system engaged in "Input" mode of operation, pressing MAN REC key triggers a scan and causes MSD's of ID number to be incremented for each scan that is manually triggered via the MAN REC key. When scan is manually triggered, output will still be an integrated value; but rate relationship between scans and resetting (as previously programmed by the ID number) becomes altered.
	Defaults normal integrator dual-rate operation. Scans are made at the programmed scan interval rate and integrators are reset after every scan. MSD's of ID number do not increment when scans occur. With system engaged in "Input" mode of operation, pressing MAN REC key triggers a scan and reset; however, MSD's of ID number are not incremented (remain at "01").
	Defaults normal integrator dual-rate operation. Entering a minus (-) or "A" in the LSD position of the ID number prevents the two MSD's from incrementing (counting). Therefore, if the MSD's are any number except "01", they will remain at that number and NO resets of the integrators will be made. However, scans will continue to be integrated at the programmed scan interval rate. Also, pressing MAN REC key (with system engaged in "Input" mode) triggers a scan without incrementing the MSD's of the ID number. NOTE: Since integrators are not being reset in this operational mode, the total integration time can exceed the 1-hour limitation as specified for rated accuracy. See "Specifications" under C.3.3.
	
	Defaults normal integrator dual-rate operation. Description of operational mode is same as that given for ID numbers "0100" or "0101" above.
	

Operational Aspects (cont'd.)

EXAMPLES OF PROGRAMMED ID NUMBERS	OPERATIONAL MODE
	Defaults normal integrator dual-rate operation. Engages "Print-On-Alarm" or "Record-On-Alarm" mode of operation if "Alarm" option is included in system.[1] See operational description under main paragraph 3.5.3 and sub-paragraphs 3.5.3.1, 3.5.3.2, 3.5.3.3, and 3.5.3.4 in "Operation" section of manual. "Print-On-Alarm" operational mode is programmed into the system via keyboard programming Section 1.2.1 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual). NOTE: Integrator option is incompatible with "Print-On-Alarm" or "Record-On-Alarm" mode of operation.
	Defaults normal integrator dual-rate operation. Engages "Continuous Print" or "Continuous Record" mode. See operational description under paragraph 3.5.5 in "Operation" section of manual. "Continuous Print" or "Continuous Record" mode is programmed into the system via keyboard programming Section 1.2.2 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual). NOTE: Integrator option is incompatible with "Continuous Print" or "Continuous Record" mode of operation.
 A blank ID number can be programmed from keyboard by clearing an ID number with CLEAR ENTRY key, and then pressing the ENTER key.	Defaults normal integrator dual-rate operation and automatically reverts to "Continuous Print" or "Continuous Record" mode. See operational description under paragraph 3.5.5 in "Operation" section of manual. NOTE: Integrator option is incompatible with "Continuous Print" or "Continuous Record" mode of operation.

[1]If "Alarm" option is NOT included in system, operation automatically reverts to "Continuous Print" or "Continuous Record" mode. See operational description under paragraph 3.5.5 in "Operation" section of manual. (NOTE: Integrator option is incompatible with "Continuous Print" or "Continuous Record" mode of operation.)

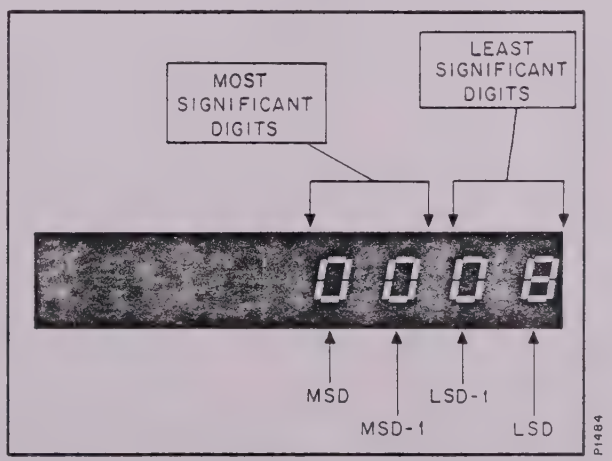


Figure C-7. Typical Programmed ID Number as Viewed on Display.

SECTION D - MISCELLANEOUS SYSTEM OPTIONS

D.1 INTERNAL REFERENCE SOURCE

a. This option is particularly useful for analog calibration checks of the PD-2064 in the field. This voltage source circuit is contained on the analog power supply card which plugs into the main card cage at the rear of the instrument. A polarity-reversal switch is included to provide accurately-regulated DC output voltages of ±.02V(20mV), ±.2V(200mV), and ±2V(2000mV). The output voltages are accurate within ±0.05% of their specified values.

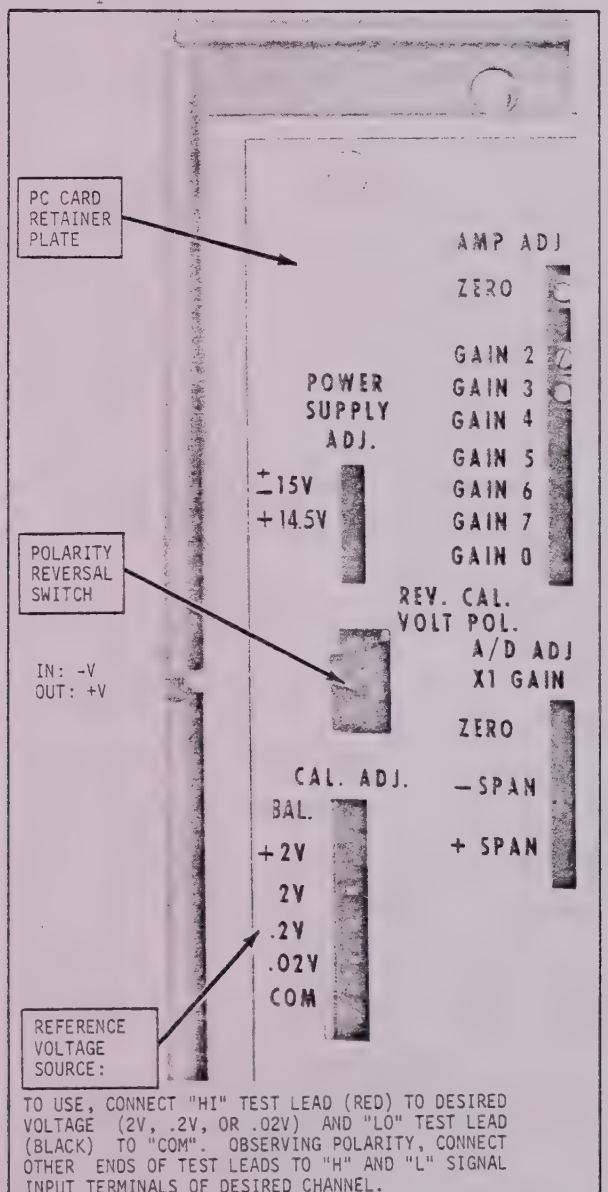


Figure D-1. Reference Voltage Source Available at PD-2064 Rear Panel.

b. The output voltages are provided at pin-type jacks, accessible through cutout in the retainer plate at rear of instrument. An accessory kit supplied with this option provides one red and one black pin-type plug for use in fabricating a set of test leads. The test leads may then be used to connect the desired calibration voltage to signal input terminals of any analog channel.

> NOTE: The internal reference voltages are referenced to the PD-2064 analog common and are not recommended for calibrating external instruments and transducers. External ground loops might be encountered that would introduce errors into the calibration voltages.

D.2 REMOTE KEYBOARD AND DISPLAY

a. This option permits operational control of the data system at a remote location from the PD-2064. A keyboard and display assembly similar to the one used in the PD-2064 is mounted in a separate package (Figure D-2).

b. The remote package may be located as far as 100 feet from the PD-2064 via an interconnecting cable between the two units. The standard interconnecting cable length supplied is 20 feet.

c. Operational details for the remote unit are the same as those for the PD-2064 keyboard and display, except that the power on-off switch is omitted on the remote unit. Refer to "Operation" section of manual.

D.3 KEYLOCK[1]

a. The electrical keylock of the keyboard permits control of the keyboard in specific ways so as to avoid inadvertent, purposeful, or unauthorized tampering with the machine's operation once the operational modes have been defined and programmed into the system.

b. There are two different production versions of keylock operation. To identify the version applicable to your specific instrument, observe the instrument's serial number. For instruments without a letter suffixed to the serial number, operational description under paragraph D.3.1 applies. For instruments with the letter "A" suffixed to the serial number, operational description under paragraph D.3.2 applies.

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[1] In early production units, keylock was available on an optional basis. In later production units, keylock was included as a standard feature.

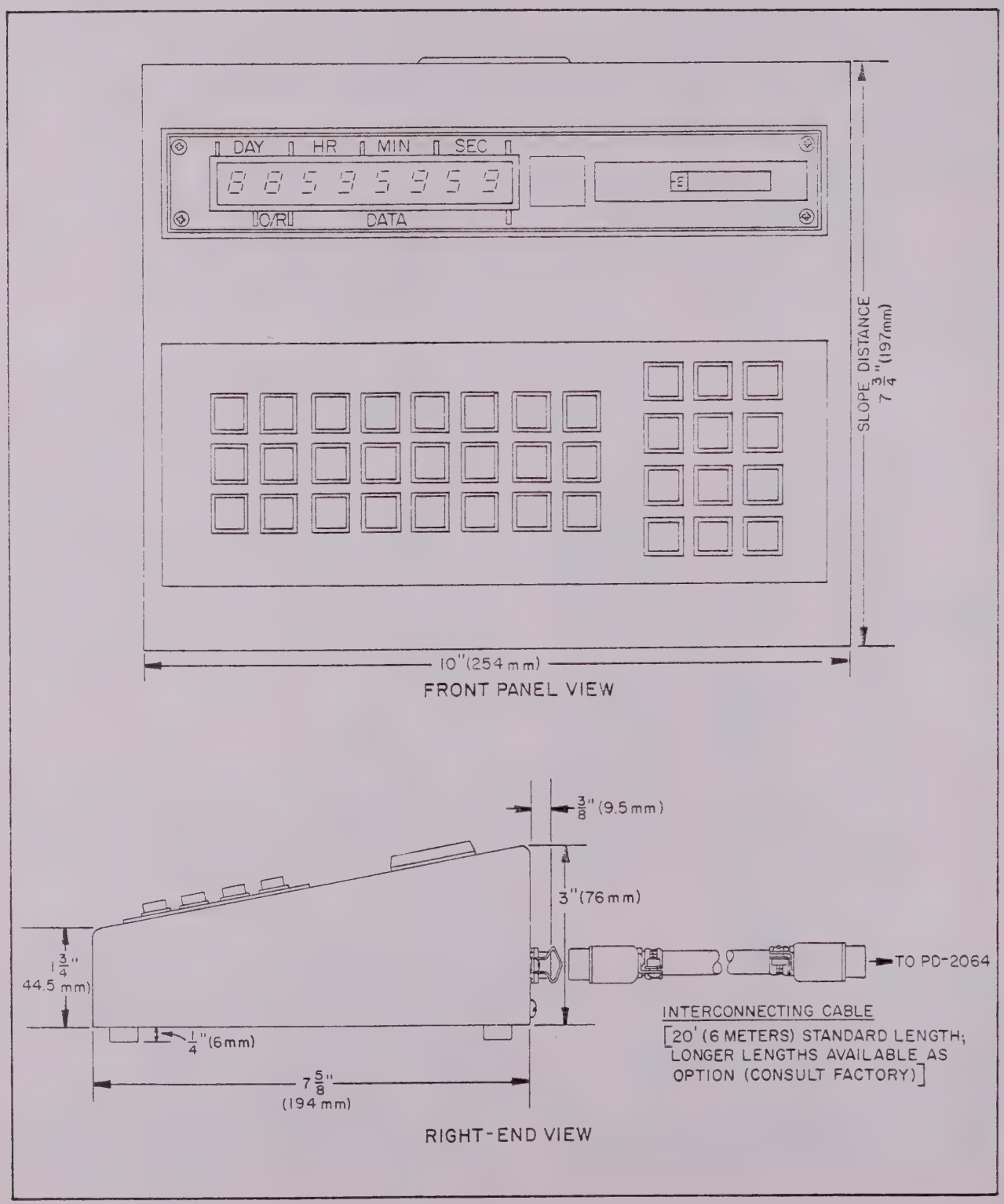


Figure D-2. Remote Keyboard & Display.

D.3.1 KEYLOCK OPERATION [1]

Keylock is operated as follows:

(1) Turn instrument power on (power key lights up). Turning power on automatically engages "Auto" mode of operation regardless of the keylock position.

(2) Insert key in keylock and turn lock counterclockwise to the "lock-in" position.

(3) With lock turned to the counterclockwise position, "Auto" mode is locked in machine. Pressing INPUT or HALT key or any of the other keys does not change or interrupt mode selection.

(4) Turn lock to clockwise position. This position unlocks the keyboard and enables normal mode selection. For example, operational mode may be switched from "Auto" to "Input" (or vice versa) by pressing INPUT or AUTO key, respectively. With system engaged in "Input" mode, keyboard entries may now be made. In addition, pressing HALT key stops operations while system is engaged in either "Auto" or "Input" mode and automatically resets the "Next Scan" time to zero.

(5) If "lock in" of "Auto" or "Input" mode is desired, press appropriate key (either AUTO or INPUT); then turn lock to counterclockwise ("lock-in") position. If "Input" mode was selected, pressing AUTO or HALT key does not change or interrupt mode selection. If "Auto" mode was selected, pressing INPUT or HALT key does not change or interrupt mode selection.

(6) Remove key from lock after desired operational mode has been "locked in".

D.3.2 KEYLOCK OPERATION [2]

Keylock is operated as follows:

(1) Turn instrument power on (power key lights up). Power fail indicator light (between the DAY digits on display) also comes on. Turning power on automatically engages "Auto" mode of operation regardless of the keylock position.

(2) Insert key in keylock and turn lock clockwise to the "lock-in" position.

(3) With lock turned to the clockwise position, "Auto" mode is locked in machine. Pressing INPUT or HALT key or any of the other keys does not change or interrupt mode selection.

(4) Turn lock to counterclockwise position. This position unlocks the keyboard and enables normal mode selection. For example, operational mode may be switched from "Auto" to "Input" (or vice versa) by pressing INPUT or AUTO key, respectively. With system engaged in the "Input" mode, keyboard entries may now be made; also, pressing the HALT key interrupts system while it is either scanning or outputting and automatically resets the "Next Scan" time to zero. With system engaged in the "Auto" mode, pressing HALT key ~~only~~ interrupts system while it is outputting ~~and maintains the programmed "Next Scan" time~~ ("Next Scan" time ~~doesn't~~ automatically reset to zero).

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NOTE: Once the "Input" mode has initially been engaged, the power fail indicator light goes off.

(5) To engage and "lock in" the "Auto" mode after a previous engagement of either the "Input" or "Auto" mode while in the unlocked position,

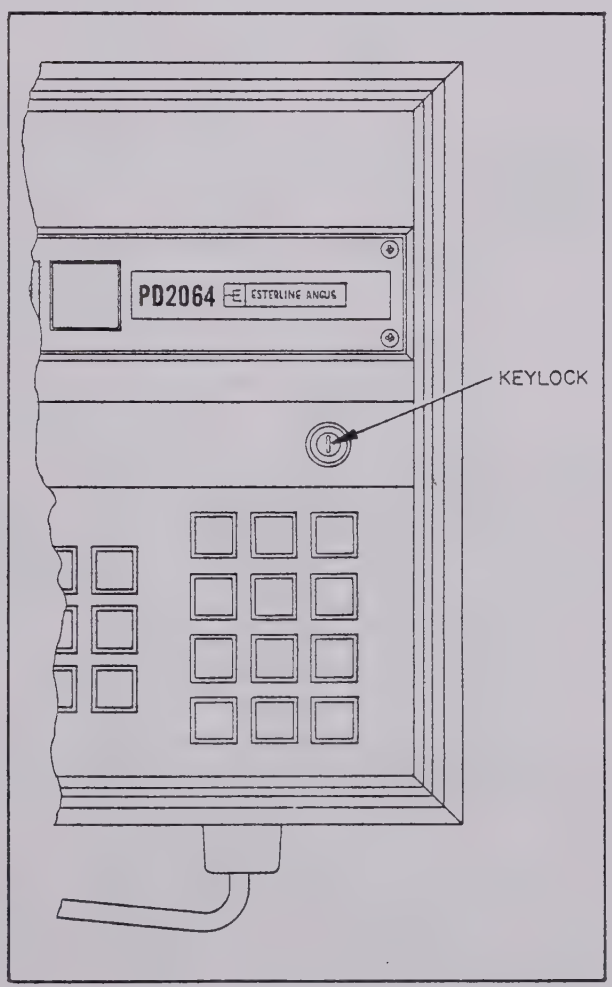


Figure D-3. Keylock Feature.

[1] For instruments without a letter suffixed to its serial number.

[2] For instruments with letter "A" suffixed to its serial number.

it is only necessary to turn the keylock to the clockwise position. Henceforth, operation is same as previously described for Step 3.

> NOTE: It is not possible to "lock in" the "Input" mode. Turning keylock clockwise automatically selects and "locks in" the "Auto" mode without the necessity of pressing AUTO key.

(6) Remove key from lock after "Auto" mode has been "locked in".

D.4 REMOTE CONTROL CONNECTOR

The remote control connector can be used to permit remote control of the PD-2064 scanning and other operational functions. It can also be used with various output devices to greatly increase the flexibility of the instrument. Various functions are provided for use in system operation of PD-2064 with external devices. One important advantage is that the PD-2064 cannot be interrupted while being keyboard programmed. A remote scan request will be ignored unless the PD-2064 is in the "Auto" mode.

Table D-1. Signal Connections.[1]

REAR PANEL CONNECTOR PIN NO.	DESCRIPTION	FUNCTION
1	+5V Switched	This line is low during "Auto" mode (not scanning) or power failure.
6	Channel Interval Override	Grounding this line causes the PD-2064 to channel advance at its maximum speed.
7	End of Conversion	Pulse indicates channel has been read.
8	Power Fail Indicator	Goes low in the event of power failure.
19	+5V	100 mA maximum.
20	-10V	20 mA maximum.
21	Remote Scan Hold-off	Prevents timed scan when low.
22	Remote Scan Trigger	Low triggers a scan when unit is in "Auto" mode.
23	Ground	Chassis (digital ground)
24	End of Scan	Indicates scan has been completed.
26	Print Enable	Low disables printer.

[1]Logic signals are TTL level, unbuffered, with 1 unit load capacity.

D.5 AUTO-RANGING OPTION

D.5.1 GENERAL

a. The auto-ranging feature permits automatic range selection from among the standard analog input measuring ranges of ±40 mV, ±400 mV, and ±4000 mV. As given in the tabulation of the "Channel Constant Programming Codes" on the Data Sheet, range codes of 1 (gain of 1), 2 (gain of 10), and 3 (gain of 100) correspond to the 4000 mV, 400 mV, and 40 mV measuring ranges, respectively.

> NOTE: Auto-ranging option is applicable to analog inputs (except TC) only -- not to digital inputs.

b. Although this option may be included in systems that utilize either single-channel programming or channel-pair programming, the most practical, versatile, and efficient application is for individual-channel programming systems. If this option is included in a channel-pair programming system, it should be remembered that the range automatically selected for the first channel of the pair remains as the range for the second channel of the pair. Although auto-ranging of channel pairs may be desirous in some applications, its use is more advantageous in the single-channel programming system, especially in systems with fewer channels.

D.5.2 AUTO-RANGE COMPONENTS

a. The components required for the auto-ranging option consist of two plug-in ROMs -- ROM 7 and ROM 10 (located on the CPU card).

> NOTE: For location of CPU card and ROM positions on CPU card, refer to Figures 1-2 and 1-3, respectively, in Section 1 of the manual.

b. ROM 7 functions as the "custom read control" program and is identified by E. A. part number ROM130207002. ROM 10 functions as the "auto-range control" program and is identified by E. A. part number ROM130210006.

c. Addition of Auto-Ranging in the Field: If auto-ranging option is added in the field, any existing optional ROM occupying ROM 10 position must be unplugged and substituted with the ROM 10 "auto-range control" program (ROM130210006). Likewise, the basic "A/D read control" program of ROM 7 (ROM130207001) must be unplugged and substituted with the ROM 7 "custom read control" program (ROM130207002).

> NOTE: The addition of the auto-range option precludes the original program functions of ROMs 7 and 10.

D.5.3 AUTO-RANGE PROGRAMMING

a. The auto-ranging feature may be programmed into the system operation by the "Custom Program Initialization" option (see paragraph 3.5.1 in Section 3 of manual) if specified by user requirements at time of order; or it may be programmed by direct keyboard entry. Programming is accomplished by the entering of a channel constant correction function code of 2 (without alarms) for channels on which auto-ranging is desired.

> NOTE: If system is equipped with the "Alarm" option, do not enter "alarms" correction function code (A) along with the correction function code of 2. Although this combination of codes forms a valid 2-character correction function (2A), alarms will function in an invalid manner.

b. Channels that are not programmed with the auto-ranging feature retain their existing correction function, range, and units codes without being affected by the auto-range programming.

c. If auto-ranging is programmed by keyboard entry, proceed as follows:

(1) Refer to left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual).

(2) Follow flow route numbers 1 through 4, and 6. Select desired channel numbers per Section 3.1. For each channel selected per Section 3.1, proceed to flow route numbers 20 and 22 and enter correction function code of 2 (without alarms) per Section 3.3.

> NOTE: When correction function code of 2 is entered, range code and units code are automatically set to 1 and 0, respectively. If units code of 0 is inappropriate for a particular channel, the units code for that channel may be changed to the appropriate setting by keyboard entry per Section 3.3.

d. If the programming instructions for the auto-ranging feature are included as part of the "Custom Program Initialization" option (ROM 4), auto-ranging is automatically initialized when the instrument is turned on. If it is desired or necessary to change any of the system

constants or channel constants that have been automatically initialized by the custom program, press INPUT key to engage "Input Mode" of operation. Thereafter, make required changes to system constants and channel constants by keyboard entry per appropriate Sections 2, 3.1, 3.3, 3.4, and 3.5 on flow diagram.

D.5.4 AUTO-RANGE OPERATION

a. When the auto-range is initially placed in operation, the measuring range selected for each channel that is monitored and/or recorded begins at the highest range of 4000 mV (gain of 1) as programmed by the range code of 1.

b. If this highest range selected is appropriate for a particular channel's A-D measurement of its input signal value, no range switching takes place and the range code of 1 remains in memory for the measured channel at a subsequent monitoring and/or recording of that channel.

c. However, if the range code of 1 is not appropriate for a particular channel's measurement signal, range switching occurs so that the proper measuring range (range code) is automatically selected in accordance with the A-D measurement of the channel's input signal. This new range code for a particular channel is then stored in memory for a subsequent monitoring and/or recording of that channel.

d. Therefore, whenever a range becomes inappropriate for a particular channel's signal input level, the range is automatically switched to the optimum range. In addition, the corresponding range code for the selected range is placed in memory for the next monitoring or recording operation of that particular channel.

e. As long as the same measuring range continues to be appropriate for subsequent readings and/or recordings of a particular channel, no time is lost due to range switching; therefore, no false readings are made during this time.

f. An awareness of a range change being made during the auto-range mode of operation may only be realized by a longer A-D conversion time and by a different placement of the decimal point in the channel data displayed and/or recorded.

g. Range switching occurs at the rate of one range per A-D conversion cycle. Upranging occurs above 40,000 counts, and downranging occurs below 3000 counts.

D.6 'SYSTEM SCAN AND DISPLAY' OPTION

D.6.1 GENERAL

a. This option permits automatic sequential scanning and display of channel numbers and corresponding channel data of all non-skipped, analog (non-digital) channels in a particular programmed frame of channels.

> NOTE: This option is functional only when system is engaged in the "Input Mode" of operation.

b. The readout on the display identifies the last two digits of the channel number being measured followed by five digits (plus decimal point) corresponding to the instantaneous measured data (not data stored in memory) for that particular channel. If data is a positive value, the intervening digit between the channel number and channel data is blank. If data is a negative value, minus (-) sign appears at this position in the display. See readout examples in Figure D-4.

c. Although all specified programmed correction functions (i.e., thermocouple linearization and/or alarms) are performed in a particular channel frame scan, the appropriate data-condition character or the correction function classification characters (for TC channel measurements) are not indicated on the display due to the occupancy of the channel number's last two digits in the MSD and MSD-1 positions.

> NOTE: Alarm relay outputs associated with channels that are being monitored by the "system scan and display" option are unaffected by this mode of operation. Alarm output contact closures are controlled only by the normal channel scanning and output operations.

d. Therefore, the data-condition character of high alarm (A), low alarm (.), or overrange (L) normally viewed in the MSD-1 position of the display is disabled. In like manner, the correction function classification characters of "00" (for TC channels) normally viewed in the MSD and MSD-1 positions of the display are disabled.

> NOTE: For displays of normal channel monitoring, see information under paragraphs 1.2.6 and 2.5.4 in manual.

D.6.2 ROM REQUIREMENTS

a. The components required for the "scan and display" option consist of two plug-in ROMS -- ROM 7 and ROM 10 (located on CPU card).

> NOTE: For location of CPU card and ROM positions on CPU card, refer to Figures 1-2 and 1-3, respectively, in Section 1 of manual.

b. ROM 7 functions as the "custom read control" program and is identified by E. A. part number ROM130207002. ROM 10 functions as the "scan and display control" program and is identified by E. A. part number ROM130210010.

c. Addition of "Scan and Display" Option in the Field: If this option is added in the field, any existing optional ROM occupying ROM 10 position must be unplugged and substituted with the ROM 10 "scan and display control" program (ROM130210010). Also, the basic "A/D read control" program of ROM 7 (ROM130207001) must be unplugged and substituted with the ROM 7 "custom read control" program (ROM130207002).

> NOTE: The addition of the "scan and display" option precludes the original program functions of ROMs 7 and 10.

D.6.3 PROGRAMMING OF 'SCAN AND DISPLAY' OPTION

a. Programming is accomplished by direct keyboard entry with system engaged in the "Input Mode" of operation. Proceed as follows:

(1) Refer to left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual).

(2) Follow flow route numbers 1 through 4, and 6. Set desired channel interval time (settable from minimum of 1 second to maximum of 9 seconds) with CHAN INTVL key and appropriate numeric key entry per Section 2.

(3) Select any non-skipped channel number that is included in the frame of channels to be scanned with CHAN SELECT key and appropriate numeric key entry per Section 3.1.

(4) Proceed to flow route numbers 20 and 22. Enter channel constant correction function code of 2 with CORR FUNCT key and numeric key 2 entry per Section 3.3.

(5) System is now programmed. Refer to paragraph D.6.4 for operational aspects.

(6) A synopsis of the programming procedures referred to in steps 1 through 4 above is illustrated by an example in Figure D-5.

b. The time taken to scan and display a channel before sequentially advancing to scan and display the next channel is controlled by the channel interval clock timing. This time delay (repetition rate) between channels is programmed via CHAN INTVL key and appropriate numeric key entry as described in step 2 above. Although the channel interval time setting consists of two digits, only the LSD of this setting governs the repetition rate at which the channels are scanned and displayed. A previously programmed number or any other number entered in the MSD of the channel interval time setting has no effect on the channel scan and display rate; therefore, it may be disregarded. The LSD of the channel interval rate is settable from 1 to a maximum of 9 seconds. A setting of either 0 or 1 in the LSD position provides a repetition rate of 1 second.

c. The total channel interval time setting (settable from 1-9 seconds) is used to scan each channel and to display the data of each channel scanned. After each channel is scanned and measured, the remaining portion of the channel interval time is used to display each channel's data. When channel interval time has expired for a particular channel, next non-skipped channel is scanned and displayed for the programmed channel interval time. This process is continued throughout the channel frame scan length.

NOTE: When system has been programmed for the scan and display option, the channel interval setting that controls the time delay interval between channels for normal scanning and output operations is disabled. Therefore, when a programmed scan interval is triggered, the system scans and outputs at its maximum rate with no time delay interval between channels.

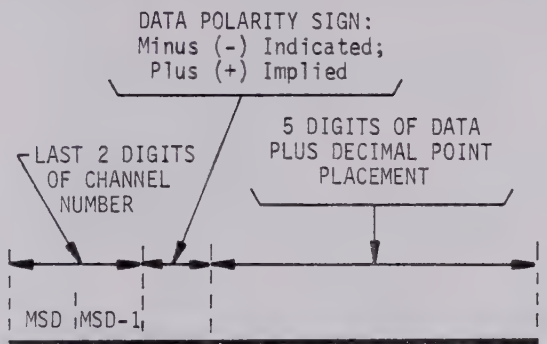
D.6.4 OPERATIONAL ASPECTS

a. After correction function code of 2 has been programmed per instructions under paragraph D.6.3, the scan and display immediately begins (at the channel interval rate) with the selected channel and continues for all the other analog channels that are included in a particular channel frame scan.

b. When the end of channel frame scan is reached, the cycle restarts at channel 000 and continues throughout the channel frame length; and when end of frame is reached again, the cycle restarts at channel 000. Cycling continues to repeat itself until a normal scan and output is triggered into operation (via SCAN INTVL programming) or until one of keys on keyboard is pressed.

NOTE: Pressing any black, gray, or white key causes mode to be interrupted. Among the red keys, only AUTO, HALT or MAN REC key causes interruption.

c. Once the scan and display mode has been interrupted, operation of mode is resumed by reprogramming the correction function code of 2 for any selected channel per example given in steps 6 through 11 in Figure D-5. When mode has been interrupted, the channel number displayed (stored in memory) when CHAN SELECT key is pressed will be the next non-skipped channel above the number that was displayed when operation was interrupted.





Data reads minus 25.413 mV for channel 002.



Data reads positive 0365.8 °F. for channel 007.



Data reads positive 412.49 mV for channel 018. Although data is in "overrange" condition, overrange character (L) that normally would appear in MSD-1 position is not indicated due to occupancy of channel number's last digit. This same MSD-1 relationship holds true for channel data that is in "alarm" condition (character . for low alarm, and character A for high alarm) and for channel data that has a TC correction function classification (character 0).

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Figure D-4. Typical Scan and Display Readouts

Given: It is desired to begin the "System Scan and Display" mode of operation at channel number "007" with a 5-second channel interval time between channels.

Example: Press following designated keys in sequence shown:

1. POWER — Turns instrument on and engages "Input Mode" of operation for subsequent keyboard entries. Display reads all L's (initial load point).
2. INPUT
3. CHAN INTVL — Sets channel interval time (repetition rate) to 5 seconds.
4. 5
5. ENTER
6. CHAN SELECT — Selects channel "007" as the first channel to be scanned and displayed.
7. 7
8. ENTER
9. CORR FUNCT — Begins cycling of "System Scan and Display" mode of operation starting with channel "07". See display examples in Figure D-4.
10. 2
11. ENTER

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Figure D-5. Programming Example

D.7 'DUAL-RATE OUTPUT' OPTION

D.7.1 GENERAL

This option permits programmable selection of a timed relationship between the occurrence of the scans that are outputted to two output devices used in a PD-2064 data system.

> NOTE: The dual-rate output option is operational in either the "Input" or "Automatic" mode of system operation.

D.7.2 ROM REQUIREMENTS

a. The components required for the "dual-rate output" option consist of plug-in ROMs 7 and 10 which are located on the CPU card.

> NOTE: For location of CPU card and ROM positions on CPU card, refer to Figures 1-2 and 1-3, respectively, in Section 1 of manual.

b. ROM 7 functions as the "custom read control" program and is identified by E. A. part number ROM130207002. ROM 10 functions as the "dual-rate output control" program and is identified by E. A. part number ROM130210008.

c. Addition of "Dual-Rate Output" Option in the Field: If this option is added in the field, any existing optional ROM occupying ROM 10 position must be unplugged and substituted with the ROM 10 "dual-rate output control" program (ROM130210008). Also, the basic "A/D read control" program of ROM 7 (ROM130207001) must be unplugged and substituted with the ROM 7 "custom read control" program (ROM130207002).

> NOTE: The addition of the "dual-rate output" option precludes the original program functions of ROMs 7 and 10.

D.7.3 PROGRAMMING OF 'DUAL-RATE OUTPUT' OPTION

a. This option is programmed into the system operation via the 4-digit, channel frame identification number. The ID number is programmed by the ID key and appropriate numerical entry from the keyboard.

b. The programmable ID number consists of a 4-digit number. The control functions of the number are subdivided into two, 2-digit numbers as illustrated in Figure D-6.

D.7.3.1 ID LEAST SIGNIFICANT DIGITS

a. The two least significant digits of the ID number (LSD and LSD-1) control the output rate ratio of the scans that are outputted to devices 1 and 2. This segment of the ID number sets the number of scans ("N") that are outputted to device 2 at the programmed scan interval rate before a scan is permitted to be outputted to device 1. In this manner, an output to device 1 occurs once for every "N" number of scans that are outputted to device 2, or as expressed in the following equation:

"N" number of scans outputted to device 2 at programmed scan interval rate (maximum "N" = 99) = one scan outputted to device 1

b. For example, with a programmed scan interval rate of 6 minutes, a number of 10 set in the least significant digits causes 9 scans at 6-minute intervals to be outputted to device 2. When 10th scan is outputted 6 minutes later, output is made to both devices--first to device 1, and then to device 2.

c. In the example cited above, a dual-rate output to devices 1 and 2 is established at an output rate ratio of 1:10. That is, an output rate of 1 scan every 6 minutes is delivered to device 2; and an output rate of 1 scan every 60 minutes (10 scans x 6 minutes) is delivered to output device 1 to provide the ratio of 1:10. This output relationship may be expressed in equation form as follows:

$$\frac{\text{Output to device 2 every 6 minutes}}{\text{Output to device 1 every 60 minutes}} =$$

output rate ratio of 1/10 or 1:10; that is, one output to device 1 for every ten outputs to device 2. (NOTE: Tenth output is delivered to both devices--first to device 1, and then device 2)

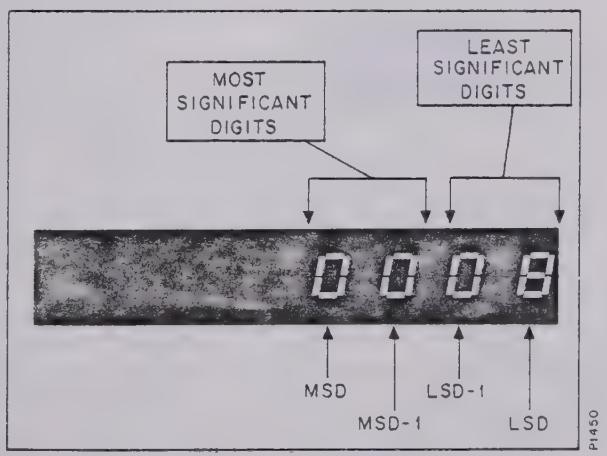


Figure D-6. Typical Programmed ID Number as Viewed on Display.

D.7.3.2 ID MOST SIGNIFICANT DIGITS

a. The two most significant digits of the ID number (MSD and MSD-1) automatically keep count of the number of scans that have been outputted to device 2. Whenever the most significant digits become equal to the least significant digits, the most significant digits are automatically reset to "01" at the next scan interval time.

b. When the count of "01" occurs, the same scan is outputted to device 1 first, and then to device 2. After the most significant digits are reset to "01", counting cycle continues to repeat itself--beginning at the "01" count and ending at the count which has been set for the least significant digits. When initially programming the ID number, the two most significant digits are normally set to "00".

D.7.3.3 PROGRAMMING EXAMPLE

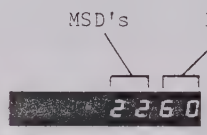
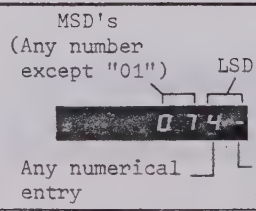
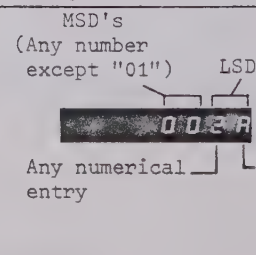
An example for setting the "dual-rate output" option into the system operation is illustrated in Figure D-7.

D.7.3.4 OUTPUT EXAMPLE

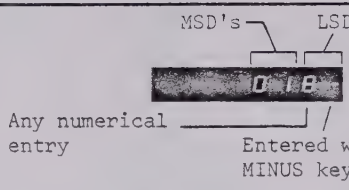
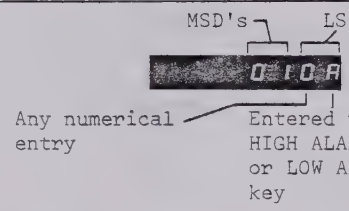
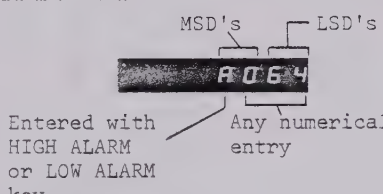
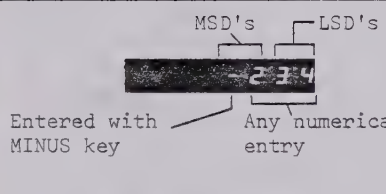
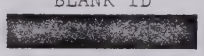
Using the example cited in Figure D-7, typical channel frame printouts from two "Seiko" printer output devices are illustrated in Figure D-8.

D.7.4 OPERATIONAL ASPECTS

Various operational aspects of a system employing the dual-rate output option are affected depending on how the ID number has been programmed. These are summarized in the following table.

EXAMPLES OF PROGRAMMED ID NUMBERS	OPERATIONAL MODE
	Normal dual-rate output operation when I-O code is programmed for output to both devices[1]. With ID initially programmed at "0060", the two most significant digits of the ID number currently indicate that "22" scans have been outputted to device 2 (initial scan was outputted to both devices 1 and 2). The two least significant digits of the ID number indicate that "60" scans are to be made to output device 2 before an output is made to device 1. The most significant digits are reset to "01" at time of 60th scan and output is delivered to both devices 1 and 2 (first to device 1, and then to device 2). With system engaged in "Input" mode of operation, pressing MAN REC key triggers an output to device 2 and causes MSD's of ID number to be incremented for each output that is manually triggered to device 2 via the MAN REC key.
 	Defaults normal dual-rate output operations. Outputting operations are made to devices 1 and/or 2 at the programmed scan interval rate and according to the programmed I-O code. MSD's of ID number do not increment when outputs occur. With system engaged in "Input" mode of operation, pressing MAN REC key triggers an output to devices 1 and/or 2 according to the programmed I-O code; however, MSD's of ID number are not incremented (remain at "01").
 	Defaults normal dual-rate output operations[1]. Entering a minus (-) or "A" in the LSD position of the ID number prevents the two MSD's from incrementing (counting). Therefore, if the MSD's are any number except "01", they will remain at that number and no scans will be outputted to device 1. However, scans will be outputted to device 2 at the programmed scan interval rate. Also, pressing MAN REC key (with system engaged in "Input" mode) triggers an output to device 2 without incrementing the MSD's of the ID number.

OPERATIONAL ASPECTS (Continued)

EXAMPLES OF PROGRAMMED ID NUMBERS	OPERATIONAL MODE
	Defaults normal dual-rate output operations. Description of operational mode is same as that given for ID numbers "0100" or "0101" above.
	
	Defaults normal dual-rate output operation. Engages "Print-On-Alarm" or "Record-On-Alarm" mode of operation if "Alarm" option is included in system[2]. See operational description under main paragraph 3.5.3 and sub-paragraphs 3.5.3.1, 3.5.3.2, 3.5.3.3, and 3.5.3.4 in "Operation" section of manual. "Print-On-Alarm" operational mode is programmed into the system via keyboard programming Section 1.2.1 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual).
	Defaults normal dual-rate output operations. Engages "Continuous Print" or "Continuous Record" output mode to devices according to programmed I-O codes. See operational description under paragraph 3.5.5 in "Operation" section of manual. "Continuous Print" or "Continuous Record" mode is programmed into the system via keyboard programming Section 1.2.2 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual).
BLANK ID  A blank ID number can be programmed from keyboard by clearing an ID number with CLEAR ENTRY key, and then pressing the ENTER key.	Defaults normal dual-rate output operations and reverts to "Continuous Print" or 'Continuous Record" output mode to devices according to programmed I-O codes. See operational description under paragraph 3.5.5 in "Operation" section of manual.

[1]I-O code is programmed so that output is permitted to both devices 1 and 2; i.e., code 3 for analog channels and/or code 7 for digital channels.

[2]If "Alarm" option is NOT included in system, operation reverts to "Continuous Print" or "Continuous Record" output mode to devices according to programmed I-O codes. See operational description under paragraph 3.5.5 in "Operation" section of manual.

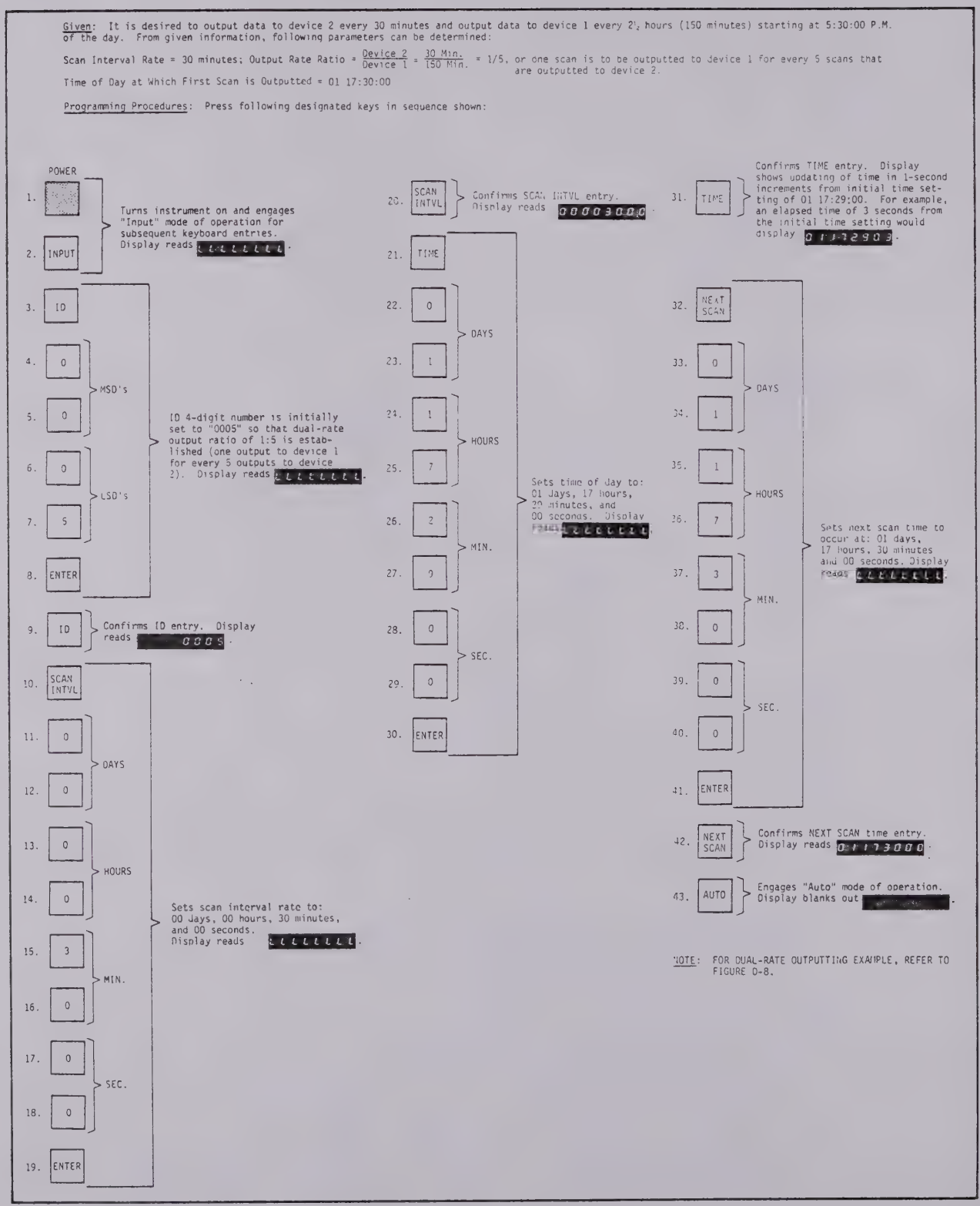
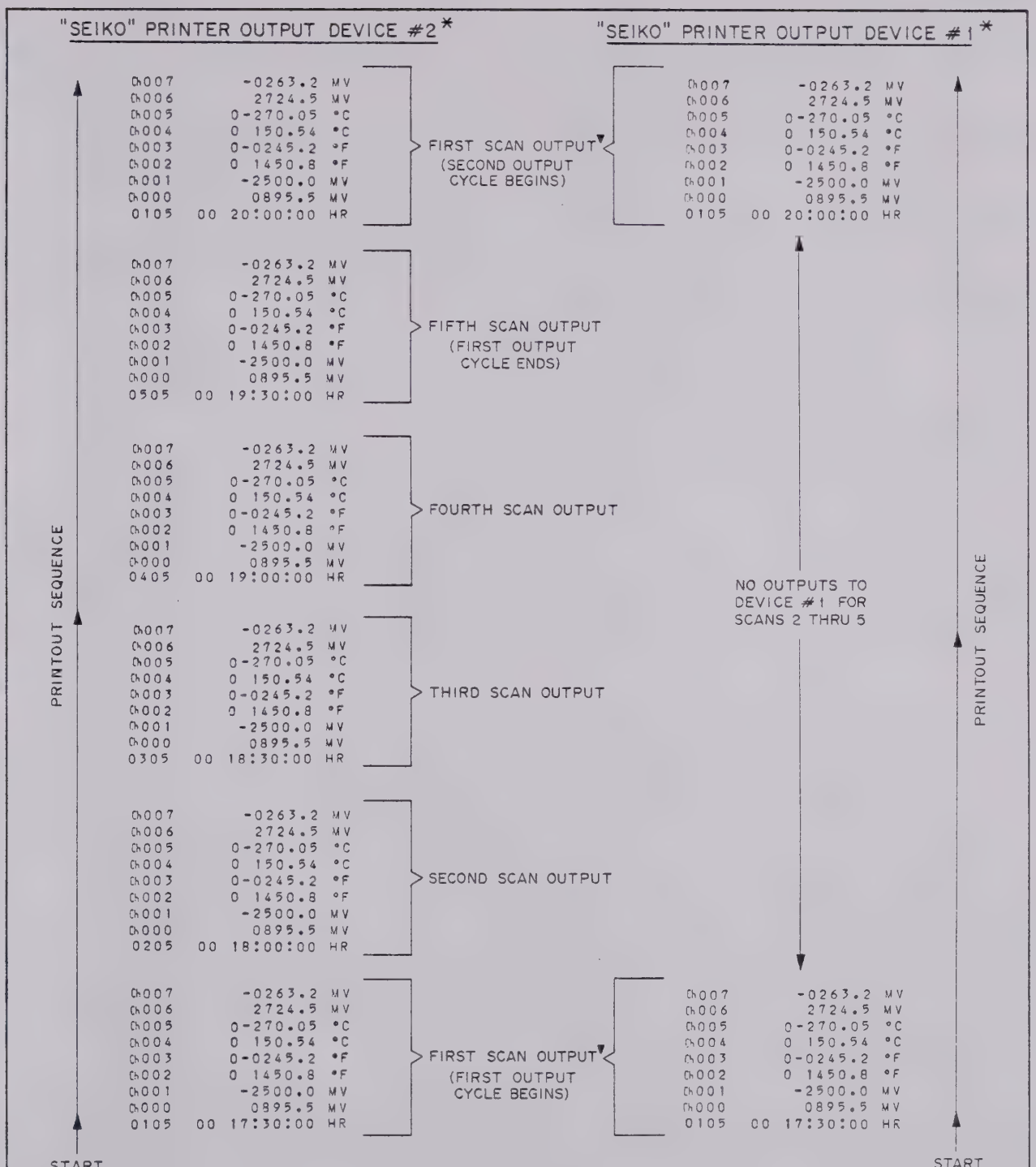

Given: It is desired to output data to device 2 every 30 minutes and output data to device 1 every 2½ hours (150 minutes) starting at 5:30:00 P.M. of the day. From given information, following parameters can be determined:
Scan Interval Rate = 30 minutes; Output Rate Ratio = Device 2 / Device 1 = 30 Min. / 150 Min. = 1/5, or one scan is to be outputted to device 1 for every 5 scans that are outputted to device 2.
Time of Day at Which First Scan is Outputted = 01 17:30:00
Programming Procedures: Press following designated keys in sequence shown:
POWER
1.
2. INPUT
Turns instrument on and engages "Input" mode of operation for subsequent keyboard entries. Display reads LLLLLLLL.
3. ID
4. 0
5. 0
MSD's
6. 0
7. 5
LSD's
8. ENTER
ID 4-digit number is initially set to "0005" so that dual-rate output ratio of 1:5 is established (one output to device 1 for every 5 outputs to device 2). Display reads LLLLLLLL.
9. ID
Confirms ID entry. Display reads 0005.
10. SCAN INTVL
11. 0
12. 0
DAYS
13. 0
14. 0
HOURS
15. 3
16. 0
MIN.
17. 0
18. 0
SEC.
19. ENTER
Sets scan interval rate to: 00 days, 00 hours, 30 minutes, and 00 seconds. Display reads LLLLLLLL.
20. SCAN INTVL
Confirms SCAN INTVL entry. Display reads 00003000.
21. TIME
22. 0
23. 1
DAYS
24. 1
25. 7
HOURS
26. 2
27. 9
MIN.
28. 0
29. 0
SEC.
30. ENTER
Sets time of day to: 01 days, 17 hours, 29 minutes, and 00 seconds. Display reads LLLLLLLL.
31. TIME
Confirms TIME entry. Display shows updating of time in 1-second increments from initial time setting of 01 17:29:00. For example, an elapsed time of 3 seconds from the initial time setting would display 01172903.
32. NEXT SCAN
33. 0
34. 1
DAYS
35. 1
36. 7
HOURS
37. 3
38. 0
MIN.
39. 0
40. 0
SEC.
41. ENTER
Sets next scan time to occur at: 01 days, 17 hours, 30 minutes and 00 seconds. Display reads LLLLLLLL.
42. NEXT SCAN
Confirms NEXT SCAN time entry. Display reads 01173000.
43. AUTO
Engages "Auto" mode of operation. Display blanks out.
NOTE: FOR DUAL-RATE OUTPUTTING EXAMPLE, REFER TO FIGURE D-8.
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Figure D-7. Programming Example for Dual-Rate Output Option.



NOTES: * I-O CODE IS PROGRAMMED SO THAT OUTPUT IS PERMITTED TO BOTH DEVICES #1 AND #2 (i.e., CODE 3 FOR ANALOG CHANNELS AND/OR CODE 7 FOR DIGITAL CHANNELS).

▼ WHEN FIRST SCAN OUTPUT IS MADE, CHANNEL FRAME IS OUTPUTTED TO DEVICE #1 FIRST, AND THEN TO DEVICE #2.

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Figure D-8. Typical Dual-Rate Output to Two "Seiko" Printers Using Parameters Programmed in Example of Figure D-7.

D.8 'DIGITAL AVERAGING' OPTION

D.8.1 GENERAL

a. This option permits programmable selection of a timed period over which a running average of the digitized measured data is outputted at the programmed scan interval rate. At the end of each timed period, the average accumulation for each channel (that has been programmed with the averaging function) is automatically reset to zero; then, the averaging output cycle repeats itself for the timed period at the scan interval rate.

> NOTE: The "digital averaging" option cannot be combined with the "thermocouple input" option. The one option precludes the other.

b. The "digital averaging" option functions on the basis of the arithmetic method of computing averages in which a group of numerical values are added and then divided by the total number of values that comprise the group. The term "running average" means that each time a data scan is made during the time period of an averaging cycle, the output is an average of each channel's measured value for the total number of scans that have currently been made in the averaging cycle. See illustration in Figure D-9.

D.8.2 ROM REQUIREMENTS

a. The components required for the "digital averaging" option consist of three plug-in ROMs which are located on the CPU card. These ROMs are ROM 7, ROM 10, and a third ROM which may be plugged into any one of the ROM slots from ROM 11 position through ROM 13 position.

> NOTE: For location of CPU card and ROM positions on CPU card, refer to Figures 1-2 and 1-3, respectively, in Section 1 of manual. The third ROM is identified by E.A. part number ROM1302DIGAV and its ROM position is specified on the instrument Data Sheet.

b. ROM 7 functions as the "custom read control" program and is identified by E.A. part number ROM130207002. ROM 10 functions as the "dual-rate control" program (scans running average at one rate and resets the average to zero at another rate) and is identified by E.A. part number ROM130210007. The third ROM (located in any one of the ROM positions from ROM 11 through ROM 13) functions as the "digital averaging control" program and is identified by E.A. part number ROM1302DIGAV.

c. Addition of "Digital Averaging" Option in the Field: If this option is added in the field, proceed as follows:

(1) Unplug basic "A/D read control" program (ROM130207001) of ROM 7, and replace it with the ROM 7 "custom read control" program (ROM130207002).

(2) Unplug any existing optional ROM occupying ROM 10 position, and replace it with the ROM 10 "dual-rate control" program (ROM130210007).

(3) Plug "digital averaging control" program (ROM1302DIGAV) into any vacant ROM position from ROM 11 through ROM 13.

D.8.3 PROGRAMMING

a. The "digital averaging" option is programmed into the system operation via the 4-digit, channel frame identification number and by an assignment of a correction function code to those channels that are to have the digital averaging function.

b. The ID number is programmed by the ID key and appropriate numerical entry from the keyboard. The programmable ID number consists of a 4-digit number, the control functions of which are subdivided into two, 2-digit numbers as illustrated in Figure D-6.

> NOTE: To select desired ID number, engage "Input" mode of operation and follow appropriate procedures under Section 2 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual).

D.8.3.1 ID LEAST SIGNIFICANT DIGITS

a. The two least significant digits of the ID number (LSD and LSD-1) control the ratio of the scan and reset rates. This segment of the ID number sets the number of scans ("N") that are to be made at the programmed scan interval rate before the average accumulators are permitted to be reset. In this manner, average accumulators are reset for every "N" number of scans, or as expressed in the following equation:

"N" number of scans at programmed scan interval rate (maximum "N" = 99) = one resetting of average accumulators

b. For example, with a programmed scan interval rate of 6 minutes, a number of 10 set in the least significant digits causes 9 scans at 6-minute intervals to be outputted. After 10th scan is outputted 6 minutes later, average accumulators are reset to zero.

c. In the example cited above, a dual-rate ratio of 1:10 is established between the reset and scan rates. That is, 1 scan is made every 6 minutes and the average accumulators are reset every 60 minutes (10 scans X 6 minutes) to provide the ratio of 1:10. This dual-rate relationship may be expressed by the following equation:

$$\frac{\text{one scan every 6 minutes}}{\text{one reset every 60 minutes}} = \text{reset/scan ratio of 1/10 or 1:10; that is, average accumulators reset after 10 scans have been made.}$$

d. The number of scans (as programmed by the two LSD's of the ID number) multiplied by the scan interval rate is equivalent to the total averaging time period (reset rate). Expressed as an equation:

("N") X ("Scan Interval Rate") = I_T = Reset Rate

Where:

"N" = number of scans

"Scan Interval Rate" = Repetition rate at which scans are made. Set by SCAN INTVL key.

I_T = Total time period of averaging cycle.

D.8.3.2 ID MOST SIGNIFICANT DIGITS

a. The two most significant digits of the ID number (MSD and MSD-1) automatically keep count of the number of scans that have been averaged. Whenever the most significant digits become equal to the least significant digits, the most significant digits are automatically reset to "01" at the next scan interval time.

b. When the count of "01" occurs, the average accumulators are reset to zero. After the most significant digits are reset to "01", counting cycle continues to repeat itself--beginning at the "01" count and ending at the count which has been set for the least significant digits. When initially programming the ID number, the two most significant digits are normally set to "00".

D.8.3.3 CORRECTION FUNCTION CODE

a. The correction function code may be assigned per channel or per channel pair according to the programming option incorporated in system (see Data Sheet for programming option supplied).

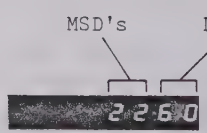
b. The proper correction function code assignment corresponds to the ROM position occupied by the "digital averaging control" ROM on the CPU card minus the factor of 8. If the ROM is plugged into the ROM 12 position, for example, a numerical entry of code 4 (12-8=4) should be entered into memory from the keyboard for those channels that are to have the digital averaging function. Upon entry of the correction function code for the appropriate channels, the range and units codes on these channels will automatically be set to a code of 1. If range and units codes of 1 is inappropriate for these channels, desired codes may subsequently be entered through the keyboard.

> NOTE: To select desired channels and their corresponding correction function, range, and units codes, engage "Input" mode of operation and follow appropriate procedures under Sections 3.1 and 3.3 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual).

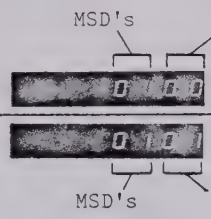
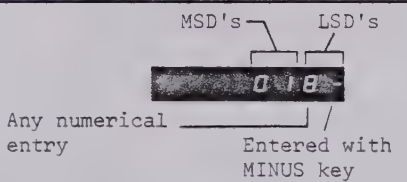
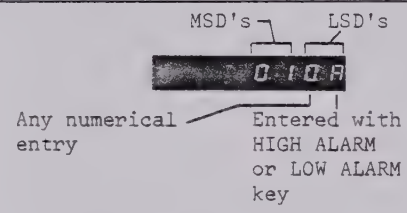
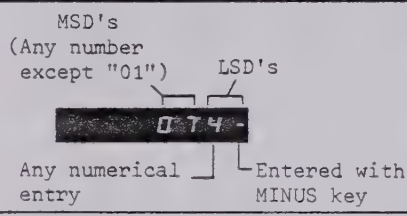
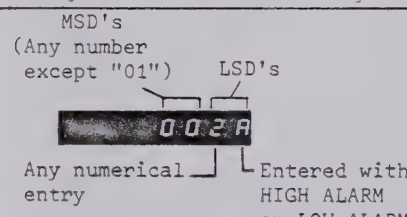
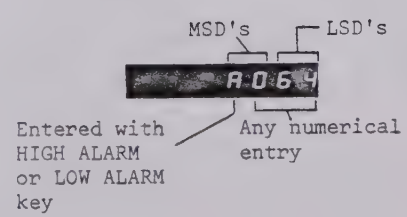
D.8.4 OPERATIONAL ASPECTS

Various operational aspects of a system employing the "digital averaging" option are affected depending on how the ID number has been programmed. These are summarized in the following table.

Operational Aspects

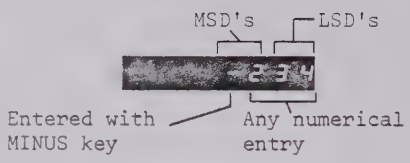
EXAMPLES OF PROGRAMMED ID NUMBERS	OPERATIONAL MODE
	Normal digital averaging operation. With ID initially programmed at "0060", the two most significant digits of the ID number currently indicate that "22" scans have been averaged. The two least significant digits of the ID number indicate that "60" scans are to be averaged before average accumulators are reset. The most significant digits are reset to "01" after time of 60th scan to cause average accumulators to reset. With system engaged in "Input" mode of operation, pressing MAN REC key triggers a scan and causes MSD's of ID number to be incremented for each scan that is manually triggered via the MAN REC key. When scan is manually triggered, output will still be a running average; but rate relationship between scans and resetting (as previously programmed by the ID number) becomes altered.

Operational Aspects (Cont'd.)

EXAMPLES OF PROGRAMMED ID NUMBERS	OPERATIONAL MODE
	Defaults normal digital averaging operation. Scans are made at the programmed scan interval rate and average accumulators are reset after every scan. MSD's of ID number do not increment when scans occur. Output values are instantaneous readings and NOT averaged readings. With system engaged in "Input" mode of operation, pressing MAN REC key triggers a scan and reset; however, MSD's of ID number are not incremented (remain at "01"). Output values are instantaneous readings and NOT averaged readings.
	Defaults normal digital averaging operation. Description of operational mode is same as that given for ID numbers "0100" or "0101" above.
	
	Defaults normal digital averaging operation. Entering a minus (-) or "A" in the LSD position of the ID number prevents the two MSD's from incrementing (counting). Therefore, if the MSD's are any number except "01", they will remain at that number and NO resets of the average accumulators will be made. However, scans will continue to be averaged at the programmed scan interval rate. Also, pressing MAN REC key (with system engaged in "Input" mode) triggers a running average scan without incrementing the MSD's of the ID number.
	
	Defaults normal digital averaging operation. Engages "Print-On-Alarm" or "Record-On-Alarm" mode of operation if "Alarm" option is included in system.[1] See operational description under main paragraph 3.5.3 and sub-paragraphs 3.5.3.1, 3.5.3.2, 3.5.3.3, and 3.5.3.4 in "Operation" section of manual. "Print-On-Alarm" operational mode is programmed into the system via keyboard programming Section 1.2.1 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual. NOTE: Digital averaging option is incompatible with "Print-On-Alarm" or "Record-On-Alarm" mode of operation.

[1] If "Alarm" option is NOT included in system, operation automatically reverts to "Continuous Print" or "Continuous Record" mode. See operational description under paragraph 3.5.5 in "Operation" section of manual. (NOTE: Digital averaging option is incompatible with "Continuous Print" or "Continuous Record" mode of operation.)

Operational Aspects (Cont'd.)

EXAMPLES OF PROGRAMMED ID NUMBERS	OPERATIONAL MODE
	Defaults normal digital averaging operation. Engages "Continuous Print" or "Continuous Record" mode. See operational description under paragraph 3.5.5 in "Operation" section of manual. "Continuous Print" or "Continuous Record" mode is programmed into the system via keyboard programming Section 1.2.2 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual). NOTE: Digital averaging option is incompatible with "Continuous Print" or "Continuous Record" mode of operation.
BLANK ID  A blank ID number can be programmed from keyboard by clearing an ID number with CLEAR ENTRY key, and then pressing the ENTER key.	Defaults normal digital averaging operation and automatically reverts to "Continuous Print" or "Continuous Record" mode. See operational description under paragraph 3.5.5 in "Operation" section of manual. NOTE: Digital averaging option is incompatible with "Continuous Print" or "Continuous Record" mode of operation.

GIVEN: IT IS DESIRED TO OUTPUT THE AVERAGE OF MEASURED DATA FOR CHANNELS 000 THRU 007 FOR AN AVERAGING CYCLE OF 30 MINUTES AT A SCAN INTERVAL RATE OF 6 MINUTES. AVERAGING CYCLE IS TO START AT 5:30:00 P.M. OF THE DAY. FROM GIVEN INFORMATION, FOLLOWING PARAMETERS MAY BE DETERMINED AND PROGRAMMED VIA THE KEYBOARD WHILE SYSTEM IS ENGAGED IN "INPUT" MODE OF OPERATION:

(1) RESET/SCAN RATIO = $\frac{\text{ONE SCAN EVERY 6 MINUTES}}{\text{ONE RESET EVERY 30 MINUTES}} = \frac{1}{5}$ (i.e., AVERAGE ACCUMULATORS RESET AFTER 5 SCANS HAVE BEEN AVERAGED).

(2) THE RESET/SCAN RATIO OF 1:5 IS PROGRAMMED INTO THE ID NUMBER BY INITIALLY SETTING THE ID NUMBER TO "0005." WHEN FIRST SCAN IS MADE AT TIME OF 01 DAYS, 17 HOURS, 30 MINUTES, AND 00 SECONDS, AVERAGE ACCUMULATORS RESET TO ZERO AND MSD's OF ID NUMBER INCREMENT TO "01" INDICATING THAT FIRST SCAN OF AVERAGING CYCLE HAS BEEN MADE.

(3) CHANNELS 000 THRU 007 ARE PROGRAMMED FOR THE "DIGITAL AVERAGING" FUNCTION BY SETTING THE APPROPRIATE CORRECTION FUNCTION CODE. APPROPRIATE RANGE, UNITS, AND I-O CODES FOR CHANNELS 000 THRU 007 ARE ALSO SET.

(4) SCAN INTERVAL RATE IS SET TO 00 DAYS, 00 HOURS, 30 MINUTES, AND 00 SECONDS.

(5) TIME IS SET TO PREVAILING TIME OF DAY (i.e., IN DAYS, HOURS, MINUTES, AND SECONDS).

(6) NEXT SCAN TIME IS SET TO 01 DAYS, 17 HOURS, 30 MINUTES, AND 00 SECONDS.

(7) AFTER PROGRAMMING SYSTEM, "AUTO" MODE OF OPERATION MAY BE ENGAGED IF DESIRED.

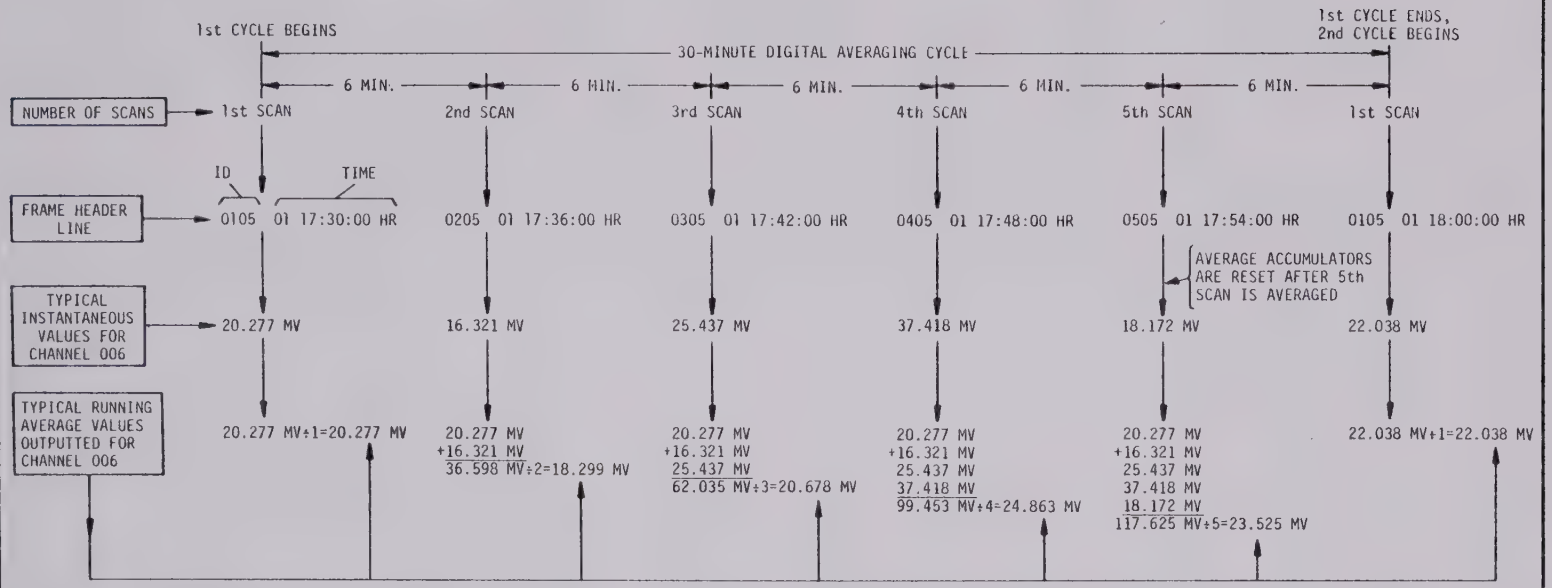


Figure D-9. Analysis of Digital Averaging Cycle (Typical Averaged Data Shown for Channel 006 only).

P1481

D.9 "SYSTEM PROGRAM STORAGE BANK" OPTION

D.9.1 GENERAL

a. This option permits a predetermined number of complete and different system operating programs to be entered into the operating memory from the keyboard by: (1) placing each operating program into a memory bank for safe-keeping, and then (2) later recalling a desired program from the bank to establish the system's prevailing operating configuration.

b. Some terms used herein to describe the Program Bank option are defined as follows:

Program: A sequence of instructions that tells the microprocessor how to receive, store, process, and deliver information.

Bank: A group of similar devices (i.e., RAMs) connected and used together to store information. A complete program bank has total storage capability of 4,096 memory words = 8 file locations = 16 RAMs.

File Number: Location of the beginning of a program or location of that program in the bank. One program can be stored in several file number locations (depends on program size -- size of program is determined by the number of memory words as calculated from the formula given under paragraph D.9.3c). One file location = 512 memory words = 2 RAMs.

Read: Loads a program from the bank into active operating memory.

Write: Loads the active program from operating memory into the bank.

Entry Point: Point at which a file location number is accessible for either a "read" or "write" function of an operating program.

File Marks: Identifies the beginning of an operating program.

"Conditional Write": Loads an active program from operating memory into the bank under the condition that the addressed file location has file marks formatted in storage from a previous "unconditional write" function.

"Unconditional Write": Loads an active program from operating memory into the bank regardless of whether the addressed file location has file marks formatted in storage from a previous "unconditional write" or not. The "unconditional write" performs its own formatting of file marks into the addressed file location whenever the program is written into memory.

c. Each operational program that is generated through the keyboard and committed to memory in the program bank consists of the following parameters:

(1) System Constants: REF CHAN (reference channel), ID (identification number), CHAN INTVL (channel interval), and SCAN INTVL (scan interval).

> NOTE: TIME, NEXT SCAN and LAST SCAN parameters are not included in the "read" and "write" functions of the operating programs.

(2) Channel Constants: I-O (input-output), CORR FUNCT (correction function), RANGE, and UNITS.

(3) Alarm Setpoints (Optional): Dual-setpoint type.

d. A maximum of 8 different operating programs (depends on program size) may be keyboard generated and loaded into the program bank. The bank circuitry is powered independently of the instrument power by a pair of lithium batteries. These batteries provide storage capability of the operating programs for as long as five years.

> NOTE: Method of determining program size is calculated from a formula given under paragraph D.9.3c.

e. Program files may be recalled from bank memory and new programs written into the appropriate storage files as often as desired via instructions from the keyboard. See programming procedures under paragraph D.9.5.

D.9.2 PROGRAM BANK COMPONENTS

a. The components which comprise the Program Bank option are a plug-in Program Bank card and two plug-in ROMs.

b. The Program Bank card plugs into the "OPTION 2"(J7) connector located on the "Digital Mother Board" as shown in Figure D-10. The instructions for the Program Bank option are contained in ROM 2 (Part #ROM130202PBX) and ROM 4 (Part #ROM130204PB1) which are located on the CPU card.

> NOTE: For location of CPU card and ROM positions on CPU card, refer to Figures 1-2 and 1-3, respectively, in "Section 1" of manual. For schematic of Program Bank card, refer to "Section F" of manual.

c. Addition of "Program Bank" option in the Field: If Program Bank option is added in the field, the existing ROM occupying ROM 2 position must be unplugged and substituted with the ROM 2 (ROM130202PBX) program bank instructions. Like-

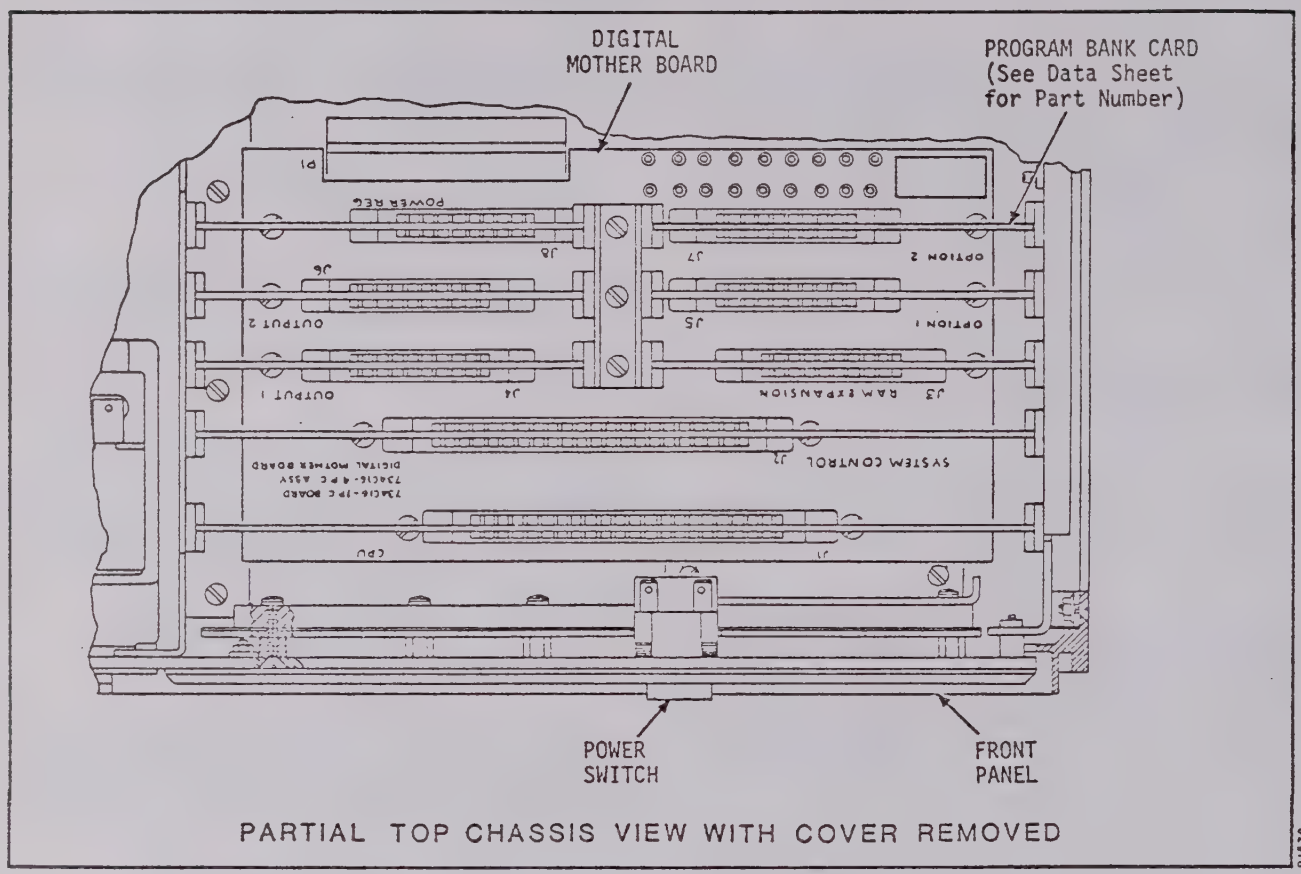


Figure D-10. Plug-In Location of Program Bank Card.

wise, if an existing ROM is occupying ROM 4 position it must be unplugged and substituted with the ROM 4 (ROM130204PB1) program bank instructions. Additionally, the program bank card must be plugged into the "OPTION 2" (J7) connector on the "Digital Mother Board" (see Figure D-10).

> NOTE: The addition of the Program Bank option precludes the original ROM 2 and ROM 4 instructions. Since the ROM 4 position on the CPU card contains the instructions for both the "Custom Program Initialization" option and "Program Bank" option, inclusion of one of these options in the data system precludes the other. Both of these options cannot be included in the same system.

D.9.3 MEMORY ALLOCATION ON PROGRAM BANK CARD

a. The memory bank provides a total program storage capacity of 4,096 memory words when this system option includes a full complement of RAM files on the card as shown in Figure D-11. However, anywhere from one to eight storage files may be provided on the card according to the customer's specifications at time of instrument order. Refer to the "System Options" section on Data Sheet to find number of files provided in your system.

b. The total storage capacity on the card is divided into eight equal file locations ("File 0" through "File 7") with each file capable of storing up to 512 memory words. Each file location is an entry point for performing a "read" or "write" function of the operating program. All contiguous memory elements between file locations (or entry points) may be used to store a single program. Operating programs which are longer than 512 words automatically run over into the next consecutive file; consequently, the remainder of the file (and its entry point) that caught the overrun cannot be used to store another program. The available file locations on the card may be assigned to program storage as required, depending upon the size of the program to be stored.

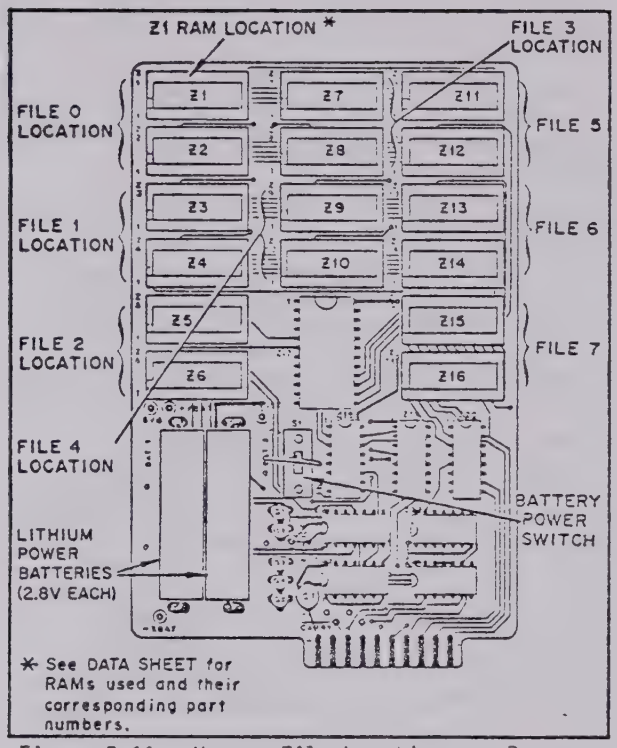


Figure D-11. Memory File Locations on Program Bank Card.

c. The program size for most standard system applications can be calculated by the following formula:

Memory Words/Program = 34 + 6(C+1)+13(A+1):

where 34 is "overhead" information (system constants); C is number of channel addresses (either single channel or channel pairs in assigned memory only); and A is number of dual-setpoint alarms (includes total dual-setpoint alarm capability in assigned memory as well as unassigned memory).

d. Since each file location can store up to 512 memory words, the calculated program size is divided by "512" to determine the number of storage files required. As an example, assume a system has 160 channel inputs (programmed in 80 channel pairs) and 16 dual-setpoint alarms. Using the above formula and substituting:

34+6(80+1)+13(16+1) = 34+486+221 = 741 memory words

Dividing the total number of memory words by 512, we find that two files will be required for this example due to length of program running over from file 0 into file 1. If two additional programs of similar length were to be stored, a total of six files would be needed. Entry points for these programs would then be file numbers 0, 2, and 4, respectively. Table D-2 shows some typical memory file requirements for different program sizes.

Table D-2. Program Size Versus Number of Files.

NUMBER OF CHANNELS		NUMBER OF DUAL-SETPOINT ALARMS	FILES REQUIRED FOR PROGRAM
With Single Channel Programming	With Channel Pair Programming		
124	248	0	2
76	152	0	1
104	208	16	2
40	80	16	1
48	96	48	2
64	—	56	3
—	96	72	3

D.9.4 OPERATIONAL ASPECTS

a. Whenever power is returned to the instrument (after a power switch turn-off or after an occurrence of a power outtage), system operation is initially and automatically programmed according to the operating program stored in file location beginning with zero (0) of the program bank. Therefore, when operating programs are initially being written into the file locations of the bank, the starting or base program should be written into the file location beginning at zero (0); and the other alternate operating programs should be written in subsequent file locations.

b. Use of the "unconditional write" function in the keyboard programming procedures performs its own formatting of file marks into the addressed file location whenever the operating program is written into memory. Formatting with file marks is done when the MINUS key is pressed twice in the "Write Programming Procedures" (See Steps 4, 5, 6b, 7, and 8 in Figure D-13). File marks are formatted regardless of whether the addressed file location has been formatted with file marks from a previous "unconditional write" or not. Consequently, no protection is provided against destroying of programs that overrun into subsequent file locations when the "unconditional write" function is performed. Also, no indication is given by the system if insufficient memory is available to store the full program. To calculate the number of file locations required for program storage, refer to paragraph D.9.3c.

c. Use of the "conditional write" function in the keyboard programming procedures loads an operating program into the addressed file location only if file marks have already been formatted into that file location from a previous "unconditional write" function. A "conditional write" function is performed when the MINUS key is only pressed once in the "Write Programming Procedures" (see

Steps 4, 5, 6a, 7, and 8 in Figure D-13). If the addressed file location has no file marks, the program is prevented from being written as indicated by all minus (-) signs appearing in the display. Thus, the "conditional write" function provides built-in protection whereby a new program is prevented from being written into an existing program that may have run over into subsequent file locations. Again, no indication is given by the system if insufficient memory is available to store the full program.

d. For an example of a "conditional write", let's assume that an operator does not know that a program containing 700 memory words has been stored in file locations 0 and 1 (2 files required because of program overrun). If the operator wanted to write a second program into the bank at entry point 1, he would be prevented from doing so because file 1 has no file marks. On the other hand, however, the operator could write this second program over the first program in file 0 because file marks do exist in file 0.

> CAUTION: If the "conditional write" of the second program into file 0 location was longer than the original program, it is possible that other existing programs in subsequent files could be destroyed inadvertently by the overrun length of the second program. For this reason, it is quite important that each program length be calculated to determine the number of file locations for each program. For program size calculations, refer to paragraph D.9.3c.

e. The Program Bank option operates in the following modes:

Mode #1: Upon initial start-up of instrument, the operating program stored in the bank file beginning at zero (0) is automatically loaded into the current operating memory. The "Time" setting begins at zero. The "Next Scan" time is made equal to the "Scan Interval" time to cause the system to scan and output data after "one scan interval of time" has elapsed since instrument turn-on.

Mode #2: Through keyboard instructions, any program stored in the bank memory can be loaded into the current operating memory.

Mode #3: Through keyboard instructions, any program in the current operating memory can be either "unconditionally written" or "conditionally written" into the bank memory.

> NOTE: For procedures in programming these operational modes, refer to paragraph D.9.5.

D.9.5 PROGRAMMING

a. The Program Bank option may be placed into the system's operation by following the programming functions listed in Table D-3 and then referring to the prescribed programming procedures listed in the table. Perform programming functions in the sequence listed in the table.

b. When establishing the desired operating programs which are to be committed to bank memory, it is suggested that a worksheet similar to the sample shown in Figure D-12 be used for record keeping. It is further recommended that a program printout[1] be obtained for each operating program established, and the printout attached to the appropriate record sheet. Samples of program printouts are shown in Figures 3-9A and 3-9B in "Section 3" of manual, and also in Figures G-6A and G-6B in "Section G" of manual.

> NOTE: To calculate memory requirements for storage of operating programs, refer to paragraph D.9.3c.

D.9.6 HANDLING AND SERVICING PRECAUTIONS OF PROGRAM BANK CARD

a. The Program Bank card contains its own power supply consisting of two lithium batteries. Power consumption of the RAMs on the card is low, and supply batteries will have an operating life equal to a 5-year shelf life regardless of the number of data file locations used.

b. The card can be removed from the instrument and still retain its memory, provided care is taken not to place the card on a conductive surface in such a way that will electrically short out the connections on the board. Also, the battery-disconnect switch on the card should always remain in the ON position regardless of whether the card is installed or removed, in order to save its memory. The battery-disconnect switch should be turned OFF (down position) when ICs are being added or removed from the card, or when otherwise repairing the card. Placing the battery-disconnect switch in the OFF position will, of course, cause a loss of the memory.

> NOTE: Instrument power should be turned OFF when removing or installing PC cards.

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[1] Printout is obtainable only if system is equipped with the "System Constant Printout" ("Program Printout") option described under paragraph 3.5.2 in "Section 3" of manual.

PROGRAM BANK DATA RECORD

PROGRAM NUMBER _____ FILE NUMBER(S) _____ TOTAL RAM MEMORY USED _____ DATE _____

SYSTEM CONSTANTS						
REF CHAN	ID	CHAN INTVL	SCAN INTVL			
			D	H	M	S

CHANNEL NUMBER[1]	CHANNEL CONSTANTS				"CLASS A" ALARM SETPOINTS[2]	
	I-O	CORR. FUNCT	RANGE	UNITS	High	Low

"CLASS B" ALARM SETPOINTS[3]

DUAL SETPOINT NUMBER	HI ALARM SETPOINT	LO ALARM SETPOINT	SETPOINT MODE (SPECIFY ONE ONLY WITH ✓)		
			HIGH-LOW	HIGHER-HIGH	LOWER-LOW
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

CHAN NO.	DUAL SETPOINT NUMBER
000	
001	
002	
003	
004	
005	
006	
007	
008	
009	
010	
011	
012	
013	
014	
015	
016	
017	
018	
019	
020	
021	
022	
023	
024	
025	
026	
027	
028	
029	
030	
031	

NOTES:
[1] Designate "A" for analog channel or "D" for digital channel.
[2] Setpoints are assignable per certain fixed channels in system. For description and programming of "Class A" alarm system, refer to paragraph 3.5.3 and its sub-paragraphs in "Section 3" of manual.
[3] Setpoints are assignable per any channel in system. For description and programming of the "Class B" alarm system ("Assignable Dual-Setpoint Alarms" option), refer to supplemental instruction (Form #PD-2064AAS) found in "Section G" of manual.

Figure D-12. Sample Worksheet for Program Bank Option.

Table D-3. Programming Function Table.

FUNCTION:	REMARKS:	FOLLOW PROGRAMMING PROCEDURES:
1. Clearing unwanted storage data from an unprogrammed memory bank card.	This function should be done in a new program bank system where the memory bank card has had no operating programs committed to its memory, and/or when battery power switch on memory bank card had been turned off. This function prevents any unwanted data in the memory bank from affecting future operating programs and is especially necessary when "Alarms" are used. With "Alarms", if any operating memory is present beyond that which is assigned to the alarm setpoints, any data that may exist in the unassigned operating memory is stored as if it were alarm setpoint information.	a. Perform Steps 1, 2, and 3 in Figure D-13. b. Group program any range code less than 10 (0-9) for all channels in system. Refer to group programming procedures under paragraph 3.5.6 in "Section 3" of manual. c. Perform Steps 4, 5, 6b, and 8 in Figure D-13.
2. Establishing the desired operating programs and writing them into the memory bank.	The initial or base operating program should be written into the file location beginning at zero (0); and all other alternate programs should be written in subsequent file locations.	a. Set parameters of each program per the following designated procedures which are given on the left-hand, fold-out sheet of the "Operational Flow Diagram" (located at end of "Operation" section in manual): (1) "System Constants" per Section 2. (2) "Channel Constants" per Section 3.3. (3) Program Printout of System and Channel Constants per Section 1.3.2. (4) "Class A" Alarm Setpoints (fixed channel assignment) per Section 3.5. (5) Program Printout of Alarm Setpoints per Section 1.3.3. b. Set "Class B" Alarm Setpoints (any channel assignment) per procedures given in supplemental instruction (Form #PD-2064AAS) found in "Section G" of manual. Perform Step a5 above. NOTE: For group programming of channel parameters, refer to paragraph 3.5.6 in "Section 3" of manual. c. After each operating program is established and a program printout obtained of that program, write each program into the addressed file location in the memory bank per Steps 4, 5, 6b, 7, and 8 in Figure D-13.

Table D-3. Programming Function Table (Continued).

FUNCTION:	REMARKS:	FOLLOW PROGRAMMING PROCEDURES:
3. Initial start-up program read into operating memory from memory bank.	This function is automatically done when instrument is initially turned on. The operating program stored in the bank file beginning at zero (0) is automatically loaded into the current operating memory. The "Time" setting begins at zero. The "Next Scan" time is made equal to the "Scan Interval" time to cause the system to scan and output data after "one scan interval of time" has elapsed since instrument turn-on.	Turn instrument off, and then turn back on. Perform Steps a3 and a5 above to obtain program printouts. These printouts should agree with program originally written into file location beginning at zero (0).
4. Reading each program from the memory bank back into operating memory.	After the initial start-up program has been read into the operating memory from the memory bank, the programs stored in subsequent file locations in the memory bank are read into the operating memory according to the addressed file location.	Perform Steps 9-13 in Figure D-13. After each program is read back into operating memory, obtain program printouts per Steps a3 and a5 above. Each program printout should agree with each program originally written into that file location in the bank.

PROGRAMMING PROCEDURES

STEP:	PRESS:	REMARKS:	DISPLAY READS:	PROGRAMMING FUNCTION:
1.	POWER	Power key and power fail LED light.		Turns instrument on and engages "Input" mode of operation for subsequent keyboard entries. If instrument is already turned on, skip to Step 4 for "Write" function procedures and to Step 9 for "Read" function procedures.
2.		Turn keylock (if used) to appropriate position to unlock keyboard.		
3.	INPUT	Engages initial load point. Power fail LED goes off.		
4.	UNITS	Press UNITS or any other channel constant key (I-O, CORR FUNCT, RANGE) twice to engage initial load point.		Stores operating programs into file locations in the memory bank.
5.	ENTER	Either ENTER or CLEAR ENTRY key may be pressed to address the memory bank routine.		
6a.	MINUS	Press once for "conditional write" function.		
6b.	MINUS	Press twice for "unconditional write" function.		
7.	0-9	With numeric keys, address file location number into which operating memory is to be written. (Example: file location 0)	Conditional Write Unconditional Write	
8.	ENTER	If "conditional write" function was performed and the addressed file location had no file marks, program is prevented from being written. If "unconditional write" function was performed, copy of operating program is now stored in the addressed file location.		

Figure D-13. Keyboard Operation of Program Bank Option (Sheet 1 of 2).

PROGRAMMING PROCEDURES(CONT'D)

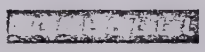
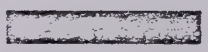
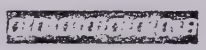
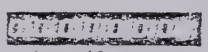
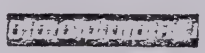
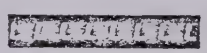
STEP:	PRESS:	REMARKS:	DISPLAY READS:	PROGRAMMING FUNCTION:
9.	UNITS	Press UNITS or any other channel constant key (I-O, CORR FUNCT, RANGE) twice to engage initial load point.		Recalls operating programs stored in memory bank into the current operating memory.
10.	ENTER	Either ENTER or CLEAR ENTRY key may be pressed to address the memory bank routine.		
11.	HIGH ALARM	Either HIGH ALARM or LOW ALARM key may be pressed to read program from memory bank into the current operating memory.	 High Alarm  Low Alarm	
12.	0-9	With numeric keys, address the file location number from which stored program is to be read into the operating memory. (Example: File location 1)	 High Alarm  Low Alarm	
13.	ENTER	The program from the addressed file location is now loaded into the operating memory.		

Figure D-13. Keyboard Operation of Program Bank Option (Sheet 2 of 2).

E GLOSSARY OF TERMS

SECTION E - GLOSSARY OF TERMS

Accuracy: The degree of freedom from error, or conformity to truth. Contrasts with resolution; Example: an improperly measured 6-digit reading may have a higher resolution, but it is less accurate than a properly computed 4-digit reading.

Address: A permanent storage register or location within a machine, and the pattern of characters that identifies it. In the PD-2064 channel addresses are identified by 3-digit reading.

ASCII: (American National Standard Code for Information Interchange, X3.4—1968). A standard 8-level code. Character set consisting of 7-bit coded characters plus a parity bit is used for information interchange among data processing systems, communications systems, and peripheral equipment. The ASCII set consists of control characters and graphic characters. Synonymous with USASCII.

Baud: A unit of signalling speed equal to the number of discrete conditions or signal events per second. Example: one baud equals one bit per second in a train of binary signals, or one 3-bit value per second in a train of signals each of which can assume one of eight different states.

BCD (Binary-Coded Decimal Notation): A position notation in which the individual decimal digits expressing a number in decimal notation are each represented by a binary numeral. Example: 23 is represented by 0010 0011 in the 8-4-2-1 type of binary coded decimal notation.

BCDIC (Binary-Coded Decimal Interchange Code): A standard information interchange code having six code channels and a seventh channel for parity.

CPU (Central Processing Unit): A main functional element of a computer that includes the circuits controlling the interpretation and execution of instructions.

Channel: A discrete path along which signals can be sent. In the PD-2064, an analog channel consists of three wires from each sensor or transducer. A standard digital channel (optional) consists of 7 digits of BCD numeric data and 1 digit for data control per each digital source (4-bit code per digit, 1 wire per bit code).

Channel Number: A three-digit number that identifies a channel.

Channel Pair: Two consecutive channels consisting of one even-number channel and one odd-number channel. Example: Channels 2 and 3. Many functions in the PD-2064 are programmed by channel pairs, rather than individually, to save time.

Cycle Time: Length of time required for the PD-2064 to make a complete scan of data measurements at the programmed rate plus the time to output the scan to one or more output devices.

Data: A representation with characters of analog quantities to which meaning is assigned that expresses facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by automatic or human means.

EBCDIC (Extended Binary Coded Decimal Interchange Code): A standard information interchange code having eight code channels and a ninth channel for parity.

Frame: A record consisting of an output of the programmed channel numbers, measurement data, units, and alarm condition (optional) of each channel plus a frame identification number and time of scan.

Hierarchical: An arrangement of programming procedures from highest and most powerful to lowest and least powerful. With the PD-2064, system control commands precede individual channel control commands.

Housekeeping Character: A letter, digit, or other symbol that controls the operation of a peripheral device in addition to formatting the data characters. Example: Characters such as carriage return, line feed, and record separation are generated and outputted by the PD-2064 Teletype interface.

Information: The meaning assigned to data by means of the known conventions used in their representation.

Initialization: Set of instructions which may (1) automatically be supplied from a special preprogrammed ROM at the time a PD-2064 is turned on, or (2) manually be entered through the keyboard in "Input" mode.

Instruction: A statement that specifies an operation and the value or locations of its operands.

Microprocessor: A large scale integrated logic circuit that supervises and controls the interconnection, sequencing, timing, measurement, input and output, and other functions of a system.

Modem (Modulator-Demodulator): A device that modulates and demodulates data signals, allowing them to be transmitted over audio communications facilities.

MUX (Multiplex): To interleave sequentially and transmit two or more messages on a single data channel. In the PD-2064 the MUX cards feed each channel in turn into the measuring circuit and microprocessor under control of the program.

Output: To copy the contents of all or a part of a storage, usually from an internal storage such as a RAM, into an external storage such as a printout. The process of copying, and also the data resulting. The output does not eliminate the data stored. A snapshot output is the copying of the contents stored in memory at one address into the PD-2064 panel display.

Parity: Equality. A parity bit is appended to an array of binary digits to make the sum of all the binary digits, including the check bit, always odd or always even. A parity check tests whether the number of ones (or zeros) in an array of binary digits is odd or even.

Print-on-Alarm: A data system condition in which continuous scanning of data channels takes place, but output of data is initiated only when an alarm condition is encountered.

PROM (Programmable Read Only Memory): A medium-scale, integrated circuit storage device containing program instructions for the microprocessor. PROMs are factory-programmable and used for custom applications.

RAM (Random Access Memory): A medium-scale, integrated circuit device that is used by the system to accept, store, and output channel measurement data, alarm setpoint data, and channel constants.

Repeatability: The closeness of agreement among a number of consecutive measurements of a constant signal approached from the same direction. Repeatability is expressed as maximum non-repeatability in per cent of span or counts of error.

Resolution: (1) The smallest incremental step in separating a measurement into its constituent parts. In a digital system, resolution is one count in its least significant digit (2) The ratio of maximum to minimum readings of a measuring system. In the PD-2064 resolution is one part in 40,000.

ROM (Read Only Memory): A medium-scale, integrated circuit storage device containing instructions pre-programmed by the ROM manufacturer. The system can obtain program instructions from the ROM but cannot alter the data in the ROM.

USASCII: See ASCII above.

SECTION F — SERVICING

F.1 FIELD SERVICE

Esterline Angus affords the instrument purchaser an outstanding network of factory-trained Service Engineers. These individuals are highly qualified to maintain, repair, or modify instrumentation at any field installation. Contact your nearest Esterline Angus Sales Office for prompt field service (see listing of Sales Offices on sheet at rear of manual). Periodic Service Agreements are also available for instrument purchasers by contacting the Esterline Angus factory. Address all requests to: Service Manager, Esterline Angus Instrument Corp., Box 24000, Indianapolis, Indiana 46224.

F.2 GENERAL SERVICING PROCEDURES

WARNING: To prevent accidental shock to person, always remove power from the instrument before disassembling or servicing.

F.2.1 SERVICING PC CARDS

a. Each PC card is identified by its part name and part number directly imprinted or etched on the card. The individual circuit components mounted on the cards are also identified by reference numbers which are imprinted on each card.

b. Guide rails for the plug-in cards are provided so that the cards can easily be guided into and withdrawn from their associated connectors. A check should be made to see that all PC cards are correctly located and firmly seated in their respective connectors. A card is firmly seated when a positive snapping action is encountered as the card is pressed into its connector. For card locations on chassis, refer to Figure 1-2 in Section 1 of the manual.

c. Built-in keying protection is provided to prevent plugging the cards in the wrong connector and/or in the wrong direction. The connectors and guide rails which accept the plug-in cards are physically positioned (keyed) so that the mating plug-in cards are only permitted to be inserted in their respective connector with component side of card facing the proper direction. The component side of cards which are housed in the card cages and those which plug into the "Digital Mother Board" should face in the direction of the arrows as shown on Figure 1-2 in Section 1 of the manual.

CAUTION: Observe the following exception to the card-keying protection. Due to card size construction and location of card edge connections, it is physically possible to plug a "digital input mux card" into a connector designated for an "analog input mux card". TO DO SO will cause malfunctions in operation along with liklihood of damage to circuit components on the card. Therefore, DO NOT inadvertently plug a "digital mux card" into a slot designated for an "analog mux card".

d. Two extender cards are available as accessories to aid in the servicing of the plug-in PC cards. These cards permit any of the plug-in cards to become accessible for troubleshooting and other test analyses under actual in-circuit operating conditions. One of the extender cards is provided with a 44-pin connector to accommodate cards having 44 card edge connections. The other extender card has a 20-pin connector for use with cards having 20 card edge connections. The extender card plugs into the chassis connector normally occupied by the functional PC card; then, the functional PC card plugs into the connector on the extender card. For part numbers of extender cards, refer to parts Table F-7 in this section of the manual.

F.2.2 HANDLING AND SERVICING PRECAUTIONS FOR MOS INTEGRATED CIRCUITS

a. Card circuitry is largely composed of solid-state components with liberal use of MOS (metal oxide semiconductor) integrated circuit devices.

b. The input protection networks designed into these devices are effective in preventing damage in a wide variety of handling and operating situations. However, to improve upon the safety factor against possible damage, special attention and consideration should be given to the following recommended practices.

F.2.2.1 STATIC CHARGES AND TRANSIENT VOLTAGES

a. Because MOS devices have extremely high input resistance, they are susceptible to damage when exposed to extremely high static electrical charges.

b. Static voltages generated by a person walking across a common waxed floor, for example, have been measured in the 4 to 15 kV range (depending

on humidity, surface conditions, etc.). This magnitude is quite high when discharged into a MOS input, considering the energy stored in the capacity (≈300 pF) of the human body at these voltage levels.

c. The built-in gate protection networks can generally only protect against overvoltage in the hundreds-of-volts range--usually sufficient for "in-socket" overvoltage, but inadequate for those magnitudes of static charge found in the handling environment.

d. To avoid possible damage to the devices during handling, testing, or actual operation, observe the following procedures:

(1) To avoid build-up of static charge, the leads of stored or unused devices should be in contact with a conductive material.[1]

(2) Devices should not be inserted into or removed from circuits with the power "on" because transient voltages may cause permanent damage.

> CAUTION: Always turn power "off" with the front panel power switch when changing or substituting cards, or when changing or substituting the plug-in IC's. Do not control on/off of power by the insertion and removal of the power cord while servicing the instrument. If it is desired to unplug power cord from the power source, first turn power off with front panel power switch, and then unplug the power cord.

(3) Signals should not be applied to the device inputs while the device power supply is off.

(4) Test equipment, soldering-iron tips, metal parts of fixtures and tools, and handling facilities should be grounded.

(5) After IC devices have been mounted on PC cards, proper handling precautions should still be observed. Until PC cards have been plugged into their respective connectors on the chassis and proper voltages applied, the PC cards will continue to act as an extension of the leads of the devices mounted on the card. Consequently, the IC devices are still susceptible to damage.

(6) When completed PC card assemblies are shipped, a conductive envelope[1] or wrapper is desirable.

F.2.2.2 STORING OF IC DEVICES

Unlike most packaged devices, MOS chips are non-hermetic devices, fragile, and small in physical size. Therefore, the following precautions should be observed:

(1) Chips should be stored under proper conditions to ensure that they are not subjected to a moist and/or contaminated atmosphere that could alter their electrical, physical, or mechanical characteristics. After the shipping container is opened, the chip should be stored under the following conditions:

(a) Storage temperature: 40°C. max.
(b) Relative humidity: 50% max.
(c) Clean, dust-free environment.

(2) The user must exercise proper care when handling chips to prevent even the slightest physical damage to the chip.

F.2.2.3 STORING OF PC CARDS

Excessive humidity (greater than 60%) should be avoided during check-out of PC cards to prevent the false impression that excessive leakage is coming from the IC device. High relative humidity may cause leakage paths between closely spaced elements of the circuit cards, such as the terminals and insulated metalized connection strips. Leakage currents on circuit cards or non-hermetic modules which are affected by high humidity become of major concern and must be controlled by coating, cleaning, or better environmental controls.

F.2.2.4 IC TESTING PRECAUTIONS

In common with many electronic components, IC devices should be operated and tested in circuits which have reasonable values of current limiting resistance, or other forms of effective current overload protection. Failure to observe these precautions can cause excessive internal heating of the device resulting in destruction and/or possible shattering of the enclosure. A reasonable value of current limiting is 0.5 to 1.0 ampere.

F.2.2.5 REPLACING IC DEVICES

When IC's are plugged into or withdrawn from their respective sockets on PC cards, extreme care should be exercised to prevent bending of the leads. Use following precautions:

(1) When inserting an IC into its socket, orient IC so that the terminal (#1) adjacent to the left side of the notch in the IC body is aligned with terminal #1 in the IC socket (as indicated by the locator dot etched on the PC card).

> NOTE: Depending on manufacturer of IC, terminal #1 of IC is sometimes identified with a dot on the IC body.

[1]See Table F-1 for sources of anti-static materials.

(2) Once the IC has been properly oriented with respect to its socket, align all leads on IC with their corresponding terminal slots in the IC socket. Then, firmly press IC into its socket with equal pressure being distributed over entire body of IC.

(3) When unplugging IC from its socket, lift with equal pressure around periphery of IC body. Lift IC straight up and out of its socket.

F.2.3 TROUBLESHOOTING AND REPAIR

a. Practically all troubleshooting and repair procedures will primarily consist of isolating the source of trouble to a particular PC card (or cards), or to a particular IC component (or components) on the PC card.

b. When troubleshooting the PC cards, it is recommended that the PC card suspected of being at fault be replaced by direct substitution with a PC card that is known to be good. On those cards that have unpluggable IC's, such as the CPU card and RAM expansion card, any individual RAM and ROM integrated circuit device suspected of being faulty should be substituted with the appropriate RAM or ROM that is known to be good. Locating a faulty card or IC device in this manner consumes very little down time and virtually ensures near-continuous operation. Refer to paragraph F.2.2 when servicing requires the handling of IC devices.

c. When instrument has been restored to normal operation by PC card substitution, a later repair of the faulty card may be accomplished by checking card components and replacing those that are defective. With the faulty card repaired, it can then serve as a spare replacement part.

d. As an aid to circuit tracing, refer to the circuit diagrams at the end of "Servicing" section. For parts replacement, refer to paragraph F.2.6 for a tabular listing of spare parts.

F.2.4 DISASSEMBLY

F.2.4.1 REMOVAL OF CASE TOP COVER

a. To gain access to internal components on the chassis, remove top cover of case as follows:

(1) From rear panel of instrument, remove 3 screws which secure the rear flange of the top cover to the upper side of the chassis rear panel.

(2) Slide cover rearward, and then lift cover up and off instrument to expose top of chassis.

b. To reinstall cover, reverse the removal procedures.

F.2.4.2 REMOVAL OF CHASSIS FROM CASE

To remove chassis from case enclosure, proceed as follows:

A. For Bench-Style Instruments

a. First, remove top cover of case per paragraph F.2.4.1.

b. If instrument is equipped with internally-mounted printer, tear off any paper feeding out of printer with tear-off bar. Snap out and remove printer access cover from chassis front panel.

c. Remove total of 8 screws (4 from upper flange of left side-rail and 4 from upper flange of right side-rail) which secure chassis to the sides of the bottom-half of case enclosure.

Table F-1. Partial List of Materials and Equipment Available for the Control of Static Charge.

COMPANY	CONDUCTIVE FOAM	CONDUCTIVE ENVELOPES	STATIC NEUTRALIZING AIR BLOWERS	ANTI-STATIC SPRAYS	CONDUCTIVE TAPE
Custom Material Inc. Chelmsford, Mass.	Velofoam #7672	Velobags #1798M	TEC Dynastat DS120		P.C. Contab Shunt
3M Company St. Paul, Minn.			Ionized Air Blower #905	See Technical Bulletins	Scotch Shielding Tapes
Scientific Enterprises, Inc. Bloomfield, Colo.			Micro Stat 575 Portable Ionizer		
Emerson & Cunning, Inc. Canton, Mass.	ECCOSORB LD26			See Technical Bulletins	

d. While holding bottom-half of case enclosure secure with one hand, grasp rear panel of chassis with other hand and lift rear end of chassis upward so that: (1) the top edge of the chassis front panel pivots under and clears the upper flange of the case's front bezel and (2) the bottom edge of the chassis front panel pivots over and clears the lower flange of the case's front bezel.

e. While continuing to hold rear end of chassis upward, simultaneously pull chassis rearward. With one hand grasping rear panel of chassis and other hand grasping front panel of chassis through printer access opening, lift and remove chassis from bottom-half of case enclosure.

NOTE: Instrument remains completely operable with chassis removed from case.

f. When reinstalling chassis in case, proceed as follows:

(1) Insert chassis in bottom-half of case so that curved lip on each side of chassis rides atop the side-rail on each side of the case.

(2) While holding case secure with one hand, grasp rear panel of chassis with other hand, lift rear end of chassis upward, and then slide chassis toward front of case so that top edge of chassis front panel slides under and around the upper flange of the case's front bezel.

(3) Reach through printer access opening in chassis front panel, and lift front panel upward so that bottom edge of the panel is lifted over and around the lower flange of the case's front bezel.

(4) With chassis properly positioned in bottom-half of case, secure chassis to sides of case with the 8 mounting screws (4 on each side). Snap printer access cover back into place on chassis front panel.

(5) Reinstall top cover of case with 3 mounting screws.

B. For Rack/Panel Instruments

a. If instrument is mounted in a rack or panel (with or without chassis slides), first dismount instrument from its mounting configuration. Thereafter, remove and reinstall chassis as given in procedures under "For Bench-Style Instruments".

b. After chassis has been reinstalled in case, remount instrument in rack or panel.

F.2.5 COMPONENT REPLACEMENT

The procedures for replacing most chassis components are obvious; therefore, detailed instructions for their removal are not given. Some components, however, can best be removed if a definite procedure is followed or if certain precautions are taken. Among these components are the following.

F.2.5.1 REPLACING POWER SWITCH

Replace power switch as follows:

(1) Remove top cover of case per paragraph F.2.4.1.

(2) Remove 6 Phillips-head screws from the display bezel. Remove bezel from front panel.

NOTE: When removing bezel, the unretained red plastic filter is likely to fall from the display window area of the bezel.

(3) Pull black cover plate forward so that terminals on power switch are accessible.

(4) Unsolder wires from faulty power switch. Press down on knurled plastic ribs which secure the switch to the plate, and remove switch from front side of plate.

(5) Snap new switch into place from front side of plate. Slip lengths of shrink tubing over ends of wires that are to be attached to power switch. Solder wires onto terminals of new switch. Slip tubing over switch terminals and shrink the tubing with heat gun. Stick a piece of black electrical tape on lift side of switch body (see positioning of tape on faulty switch that was removed).

NOTE: Tape is used to prevent power switch illumination (when switch is turned on) from entering darkened display window area when instrument is engaged in "Auto" mode of operation.

(6) Position black cover plate in place on front panel. Make sure that the red plastic filter is properly positioned over display window area in the display bezel. Secure display bezel to the front panel with 6 Phillips-head mounting screws.

(7) Reach in from top of chassis and dress power-switch leads away from sharp solder projections on the CPU card.

CAUTION: Dressing of power-switch leads is important. The sharp solder projections on the CPU card can penetrate through the insulation on the power-switch leads to cause AC to be applied to the circuit paths on the CPU card. If this should happen, certain IC devices on CPU card may suffer irreparable damage and will have to be replaced. Another reason for proper lead dress is to permit withdrawal and insertion of CPU card without snagging the power-switch leads.

(8) Reinstall top cover of case with 3 mounting screws.

F.2.5.2 REPLACING LED FRONT PANEL DISPLAY

The individual plug-in LED (light emitting diode) devices which comprise the 8-digit display are accessible for replacement from the front panel. Proceed as follows:

(1) Remove top cover of case per paragraph F.2.4.1.

(2) Remove 6 Phillips-head screws from the display bezel. Remove bezel from front panel.

NOTE: When removing bezel, the unretained red plastic filter is likely to fall from the display window area of the bezel.

(3) Using a pair of long-nosed pliers, reach through rectangular display window in black cover plate. Grasp body of defective LED between jaws of pliers and pull outward to unplug LED from its socket.

(4) Orient new LED in same position as other LEDs. Grasp body of new LED between jaws of long-nosed pliers. Reach in from top of chassis and hold upper end of "Keyboard and Display" card rigid while LED is being plugged into its socket. Align all leads on LED with their corresponding terminal slots in the LED socket. Then, partially insert LED into its socket with pliers. Press LED rest of way into socket with finger.

(5) Position red plastic filter over display window area in the display bezel. Secure display bezel to the front panel with 6 Phillips-head mounting screws.

(6) Reinstall top cover of case with 3 mounting screws.

F.2.5.3 SERVICING TOP SIDE OF CHASSIS

a. To gain access to the PC cards and other components from top side of chassis, remove top cover of case per paragraph F.2.4.1.

b. After removing top cover, check to see that all PC cards are correctly located and firmly seated in their respective connectors. For card locations on chassis, refer to Figure 1-2 in Section 1 of the manual.

c. Observe following procedures if servicing requires the removal of the following components:

A. Removal of "Digital Mother Board"

(1) Pull and remove CPU card from its connector on "Digital Mother Board".

(2) Unplug flat-ribbon control cable from its connector on "Keyboard and Display" card.

(3) Pull and remove all remaining PC cards that are plugged into their connectors on "Digital Mother Board". Lay cards atop card cage (or cages) at rear of chassis.

NOTE: It will not be necessary to disconnect other flat-ribbon cable connectors and individual wires from PC cards when removing cards from mother board. Cable and wire lengths will permit withdrawal of cards with cable and wire connections remaining intact.

(4) Remove power connector from mother board edge connector P1.

(5) Remove 3 screws from U-shaped card guide bracket, and lift bracket from top of mother board.

(6) Remove remaining 10 screws which secure mother board to the chassis. Lift mother board with individual wires left intact on pin connectors.

(7) To install mother board, reverse disassembly procedures. If new mother board is to be installed, remove wires from pin connectors on old board and insert wires onto corresponding pins of new board. After PC cards have been plugged back into their respective connectors on mother board, make sure that all flat-ribbon cables are properly dressed and plugged into their proper connectors on the PC cards. Make sure that good electrical connections are being made between plugs and sockets of cables.

NOTE: Card plug-in locations are also identified on the "Digital Mother Board".

B. Removal of "Keyboard and Display" Card

In order to remove "Keyboard and Display" card from chassis, it will first be necessary to remove "Digital Mother Board". Proceed as follows:

(1) Remove "Digital Mother Board" as given above in procedures under "Removal of Digital Mother Board".

(2) Remove 4 screws from keyboard support plate. Remove support plate.

(3) Remove 3 screws from lower PC card brace. Remove lower brace.

(4) Remove 3 screws and cable clamp from upper PC card brace. Remove upper brace.

(5) Pivot top edge of card toward rear of instrument so that keys clear the square cut-outs in the front panel cover plate. Lift card upward, swing card around left side of power switch wires, and remove card from chassis.

(6) After card has been removed from chassis, individual circuit components on card may be replaced. If any of the key switches are defective, the associated composite key switch module (KSM1, KSM2, KSM3, KSM4, KSM5, or KSM6) must be replaced as a unit. See parts listing in Table F-6 for replacement part numbers of key switch modules.

> NOTE: It is not necessary to remove card in order to replace any of the LEDs (light emitting diodes) of the display. Procedures for replacing LEDs are given under paragraph F.2.5.2.

(7) To reinstall "Keyboard and Display" card, reverse disassembly procedures.

> CAUTION: When reinstalling upper and lower PC card braces, make sure that insulated (taped) sides of braces are in contact with the card.

(8) To reinstall "Digital Mother Board", reverse disassembly procedures given above under "Removal of Digital Mother Board".

C. Cleaning "Seiko" Printer

Every 3 months--or after usage of approximately 10 packs of paper--the printer should be cleaned with a brush to remove paper chips and dust. Clean the type faces of the print drum with a hard-bristled brush or a needle point. Restrict cleaning agents to either alcohol or benzine (more harsh agents could cause damage to plastic parts consisting of the motor cover, gear cover and tear-off bar). Clear printing can be achieved only by maintaining a clean printer.

D. Removal of Internally-Mounted "Seiko" Printer

If any of the associated components of the digital printer fail (such as the motor, column trigger solenoids, paper advance solenoid, ribbon advance solenoid, or any mechanical failure), the entire digital printer must be removed and replaced as a unit. To remove and replace digital printer, proceed as follows:

(1) Tear off any paper feeding out of printer with tear-off bar. Snap out and remove printer access cover from chassis front panel. Fully extend slide-out drawer and remove the refolded paper. Tear off paper which leads into the printer from the supply pack. Tear paper off at one of the folds right below the paper-feeding guide bar which routes the paper into the printer. Remove supply pack from storage compartment. Remove portion of paper still in printer by pulling out on the paper.

(2) Unplug the cable connector from rear of printer.

(3) Remove chassis from bottom-half of case enclosure per steps c, d, and e under paragraph F.2.4.2.

(4) After removing chassis from case enclosure, position chassis on its right side. While holding printer in place from top of chassis, remove the 4 printer mounting screws from bottom side of chassis. Lower chassis from its side and lift printer from chassis. Detach mounting bracket assemblies from bottom side of printer by removing the 4 flat-head mounting screws (2 screws from each mounting bracket assembly).

(5) If not already done on replacement printer, tap holes in the four mounting ears on bottom side of printer using No. 29 (.136") drill and 8-32 tap.

(6) Apply LOCKTITE "Grade C" as a bonding agent to threads of the 4 flat-head mounting screws, and attach the two mounting bracket assemblies to bottom of printer with the 4 mounting screws.

(7) Apply LOCKTITE "Grade C" as a bonding agent to threads of the 4 printer mounting screws. Position replacement printer in line with the four mounting holes in bottom of chassis. While holding printer in place with one hand, position chassis on its right side and fasten printer to bottom side of chassis with the 4 printer mounting screws. Plug cable connector into receptacle at rear of printer.

(8) Reinstall chassis in case per steps f.1 through f.4 under paragraph F.2.4.2.

(9) Load paper in printer by following instructions given under paragraph B.3.1.4 in Section B of the manual.

NOTE: When servicing of top side of chassis has been completed, reinstall top cover of case with the 3 mounting screws.

F.2.6 SPARE PARTS LISTINGS

a. Replacement parts are available through Esterline Angus Sales Offices, a list of which may be found at the rear of this manual. Furnish any of these authorized representatives with a complete description of the part, its part number, and include the model number and serial number of the instrument when ordering parts.

b. To obtain a part that is not listed in the parts tables, include the following when ordering:

(1) Instrument model and serial numbers.

(2) Description of the part.

(3) Function and location of the part.

Table F-2. Basic PC Card (Board) Assemblies.

DESCRIPTION	E.A. PART NO.	QTY.
Analog Power Supply & Control (W/O "Internal Calibration Source" Option)	734C1-4δ	1
Amplifier & A-D Converter Assembly	734C2-θ	1
A-D Converter (Only)	190305	1
Analog Input Relay Mux (8 Channels Per Card)	734C21-4	A/R
Analog Input Mother Board	734C4-4	1
Logic Power Supply (W/O "Memory Save" Option)	734C18-5φ	1
Diode Rectifier, Logic Power Supply	734B41-5	1
System Control Card	734C9-θ¶	1
Keyboard & Display Card	734C20-4§	1
Digital Mother Board	734C16-4ζ	

δ Part #734C1-5 with "Internal Calibration Source" option.

θ Dash portion of part number dependent on system requirements. Refer to number stamped on part used in instrument.

φ Part #734C18-4 with "Memory Save" option.

¶ Part #734C135-θ used when letter "A" is suffixed to the instrument's serial number.

§ Part #734C20-6 used when letter "A" is suffixed to the instrument's serial number.

ζ Part #734C134-4 used when letter "A" is suffixed to the instrument's serial number.

Table F-3. Optional PC Card (Board) Assemblies.

DESCRIPTION	E.A. PART NO.	QTY.
Digital Input Mux (1 Channel Per Card)	734C24-4	A/R
Digital Input Mother Board (0-7 Channels)	734C23-4	1 A/R
Auxiliary Analog Input Mother Board	734C27-4	1 A/R
Digital Input Control	734C22-4	1 A/R
"Seiko" Printer Interface	734C10-4∂	1 A/R
Parallel Interface (Mag Tape or Paper Tape); "Write" Only	734C40-4	1 A/R
TTY Interface ("Write" Only)	734C25-5	1 A/R
RS-232-C Interface; Standard (Data Terminal Equipment)	734C63-4	1 A/R
Alarm Output Relay ("Common" Only)	734C67-7	1 A/R
Alarm Output Relay (High Half--8 Channels With "Common" Relay)	734C67-5	1 A/R
Alarm Output Relay (High Half--8 Channels)	734C67-8	1 A/R
Alarm Output Relay (Low Half--8 Channels)	734C67-4	1 A/R
Alarm Output Relay (Full--16 Channels)	734C67-6	A/R
Ram Expansion	734C11-4	1 A/R

∂ Part #734C10-5 used when letter "A" is suffixed to the instrument's serial number.

Table F-4. Memory Storage Devices.

DESCRIPTION	CARD LOCATION	E.A. PART NO.	QTY.
Microprocessor Plug-In Circuit (Z22); Intel Type 4004	CPU	MOS4004	1
RAM Plug-In Circuits (Z23 Thru Z34); Intel Type 4002-1 or 4002-2	CPU	MOS4002-1 or MOS4002-2 ④	A/R
RAM Plug-In Circuits (Z1 Thru Z20); Intel Type 4002-1 or 4002-2	RAM Expansion	MOS4002-1 or MOS4002-2 ④	A/R
ROM Plug-In Circuits (ROM 0 Thru ROM 15); Intel Type 1302A or 1702A	CPU	⑤	A/R

④ Refer to RAM part number tabulation (Table 2) found in Figure G-1 of Section G of manual.

⑤ Refer to Figure 1-3 and Table 1-1 in Section 1 of manual for part numbering explanation.

Table F-5. External Interconnecting Cables for Options.

DESCRIPTION	E.A. PART NO.	QTY.
Output to Texas Instrument (T.I.) Terminal	734C114	1 A/R
Output to 7- or 9-Track Mag Tape ("Write" Only)	734C98	
Output to Facit Paper Tape Perforator	734C89	
RS-232-C and RS-366 Output Interface	734C86-2	
RS-232-C (Only) Output Interface	734C86-1	
Output to TTY ("Write" Only)	734C68-2	
Alarm Output Relay to Expansion Box (Channels 24-71)	734C101	
Alarm Output Relay to Expansion Box (Channels 0-23)	734C100-1	
Analog Input to Expansion Box	734C110	
Digital Input to Expansion Box (Channels 0-15)	734C100-2	
Integrator Control (Master & Slave Units)	75C6-2	
Integrator Control (Master Unit Only)	75C6-1	
Remote Keyboard and Display	734C80	
External Battery Pack	734C100-3	

Table F-6. Miscellaneous Items.

DESCRIPTION	E.A. PART NO.	QTY.
36-Pin, Rear-Panel Connector (J3, J4); Amphenol Type 57-40360	KBR3-40360	1
50-Pin, Rear-Panel Connector (J1, J2); Amphenol Type 57-40500	KBR3-50	1
44-Pin, Solder-Terminal Connector (For Analog and Digital Signal Inputs)	KPC-55	A/R
36-Pin, Solder-Terminal connector (For Alarm Output Relay Connections)	KPC-41	A/R
Screw-Terminal Connector (For Analog Signal Inputs)	734C126	A/R
44-Pin Mating Connector for PC Cards	KPC43	1
20-Pin Mating Connector for PC Cards	KPC42	1
PC Card Guide (For Cage Cards)	GID-7	2
PC Card Guide (For Cards Which Plug Into "Digital Mother Board")	GID-1	2
Keyboard Switch Modules (Mounted on "Keyboard and Display" Card):		
KSM-1	734B18	1 A/R
KSM-2	734B19	1 A/R
KSM-3	734B20	1 A/R
KSM-4	734B21	1 A/R
KSM-5	734B22	1 A/R
KSM-6	734B23	1 A/R
Light Emitting Diode (LED) Displays; Plug Into "Keyboard & Display" Card	DSE-1	2
Display Bezel	734C39	1
Display Filter	734A10	1
"Seiko" Printer (Model EP-101)	734B24	1
Line Fuse (F1); 1A, 250V, Slo-Blo	14359-1 ⑥	2
Battery Fuses (F2, F3); For "Memory Save" Option; 2A, 125V, Slo-Blo	FAG2-2	2
6V Batteries (Bat. #1, #2); For "Memory Save" Option	BAT-3	2
4V Battery (Bat. #3); For "Memory Save" Option	BAT-4	1
Power Cord	8935-G	1
Power Switch (SW1)	SWB-15	1
Logic Power Supply Transformer (T1)	734C55	1
Analog Power Supply Transformer (T2)	734B32	1
Power Transistors (Q2, Q3, Q4); Type MJE 1100	TRA-1100	3
Power Regulator (Z5); Type 7805	OPA-7805	1
Filter Capacitor (C1); 25,000 µF @ 25V	CEL-87	1
Filter Capacitor (C2); 28,500 µF @ 15V	CEL-143	1
Filter Capacitor (C3); 12,500 µF @ 30V	CEL-142	1
Bottom Foot; Front, Right (For Case)	190169-2	1
Bottom Foot; Front, Left (For Case)	190169-1	1
Bottom Feet; Rear (For Case)	45024	2
Bail (For Case)	190169-5	1
64-Channel TC Input Panel Assembly, °F:	734D17-1	1 A/R
64-Channel TC Input Panel Assembly, °C.	734D17-2	1 A/R
32-Channel TC Input Panel Assembly, °F.	734D40-1	1 A/R
32 Channel TC Input Panel Assembly, °C.	734D40-2	1 A/R

⑥ Fuse part number FAG2-.5 for 200-240V input applications.

Table F-7. Accessories.

DESCRIPTION	E.A. PART NO.	QTY.
36-Pin Connector; Mates with PD-2064 Rear-Panel Connector J3 or J4; Amphenol Type 57-30360	91500-2	A/R
50-Pin Connector; Mates With PD-2064 Rear-Panel Connector J1 or J2; Amphenol Type 57-30500	KBR3-30500	A/R
Red/Black Ribbon for "Seiko" Printer	91500-1	2
All-Black Ribbon for "Seiko" Printer	91500-4	1 A/R
Paper Packs for "Seiko" Printer (Minimum Quantities of 12 Packs/Box)	190115	1 Box
Test Probe Kit for "Internal Calibration Source" Option	734A55	1 A/R
Extender Card (44-Pin)	734C65-3	1
Extender Card (20-Pin)	734C66-3	1
Chassis Slide Assy. (Rack Mounting); Chassis Trak Type C-300-S-1-22	CHS1	1 A/R
Rack Mounting Flanges	734B26	2 A/R
Carrying Handles (For Instrument)	MHW16-5	2 A/R
Carrying Case (For Instrument)	734C85	1 A/R
PD-2064 Programming Guide (Wheel)	734B54	1
Operational Flow Diagram Foldouts (2 Sheets)	FDKP-1	1
Programming Worksheet #1 (For Entry of Programs)	503PD	A/R
Programming Worksheet #2 (For Entry of Programs)	504PD	A/R
Instruction Manual	M734R1-1	A/R

F.2.7 CIRCUIT DIAGRAMS

a. A list of the various circuit diagrams included in the Servicing section of the manual is given below.

b. If special modifications are made to the instrument, pertinent instruction supplements, drawings, and other related documentation will be found in Section G of the manual. Refer to instrument Data Sheet for description of options or special features that may be supplied.

LIST OF CIRCUIT DIAGRAMS

DRAWING NO.	TITLE
734C105	Analog Power Supply and Control Card Schematic
734C106	Amplifier and A-D Converter Card Schematic
734C73	Analog Input Relay Mux Card Schematic
734C71	Thermocouple Mother Board Schematic
734B73	Digital Input Mux Card Schematic
734C129	Digital Input Control Card Schematic
734D19	CPU Card Schematic
734D20[1]	System Control Card Schematic
734C72 (ECN "A" Change)[2]	Keyboard and Display Schematic
734D22	RAM Expansion Card Schematic
734C76 (ECN "E" Change)[3]	"Seiko" Printer Interface Card Schematic
734C78	TTY Interconnection Diagram
734C68-2	TTY Conversion Board ("Write Only" Assy.)
734B74	TTY Interface Card Schematic
734C77	Parallel Interface Card Schematic
734C75	RS-232 Interface Card Schematic
734C74	Output Relay Card Schematic
75C8	Integrator Interconnection Diagram
75C1-S	Integrator Power Supply and Control Schematic
75C4-	Integrator Card Schematic
734R4 (ECN "A" Change)[4]	System Wiring Diagram
734C56	Logic Power Supply Schematic

[1] Use drawing #734D135-S when instrument's serial number is suffixed with letter "A".

[2] Use drawing #734C72 (ECN "C" change) when instrument's serial number is suffixed with letter "A".

[3] Use drawing #734C76 (ECN "F" change) when instrument's serial number is suffixed with letter "A".

[4] Use drawing #734R4 (ECN "D" change) when instrument's serial number is suffixed with letter "A".

Note: Instrument should be in operation in the input mode with all covers in place for 2 hours prior to calibration. Best results will be obtained if one data scan is printed prior to warm-up and again prior to calibration. Press halt to avoid scan interruptions during calibration.

Refer to Section D, Figure D-1 for location of amplifier adjustments.

1. A/D Converter calibration

Zero

a. Short the high and low of channel 0.

b. Select channel 0, set the range to 1, and press channel read.

c. Adjust "A/D ADJ; X1 GAIN" Zero for Zero ± 2 counts.

+ Span

d. Connect a + 4000.00 mV signal to channel Zero.

e. Adjust "+ Span" for 4000.0 ± 2 counts.

- Span

f. Connect a -4000.00 mV signal to channel Zero.

g. Adjust "- Span" for -4000.0 ± 2 counts.

Return to step a. and check Zero. + Span and - Span should be re-calibrated if it is necessary to readjust Zero.

2. Amplifier Adjustments

Note: All amplifiers adjustments are made with: "I/O" code = 1, 2, or 3; "Correction Function" = 0; and "Range" code = as specified. Units code is immaterial.

Range code corresponds to Gain on rear panel (i.e. Range 2 is calibrated using Gain 2). Range 1 is calibrated using A/D converter calibration procedure specified in 1. above.

Zero

a. Select the most sensitive range (usually 3). Put the instrument in the channel read mode.

b. Short the High & Low inputs to the channel being monitored.

c. Adjust "Amp Adj" "Zero" control for reading of 0± 7 counts.

Do not readjust zero beyond this point.

Gain

d. Refer to the Standard and Optional Gain Calibrations.

e. Select the appropriate range (i.e. 40.000 mV; select range 3).

f. Apply the appropriate Full Scale Input Voltage. Polarity is not important although calibration is normally accomplished with (+) polarity.

g. Put the instrument in the channel read mode.

h. Adjust for the appropriate Full Scale Display (40000 counts ignoring the decimal point).

i. Check the opposite polarity. Readings should be within 10 counts.

j. Return to step d. and calibrate the next range.

Caution: Calibration source should have low impedance output free of noise, ripple, and common mode signals. In some cases it may be desirable to "float" the calibrator's output and connect the guard to the calibrator's ground. Normal practice is to connect low and guard from the calibrator together and connect the PD-2064 guard to low. See manufacturer's recommended connections for your calibration source.

Accuracy required of the calibrator is 0.002% or better.

STANDARD GAIN CALIBRATIONS

Range	F.S. Input	*Range	F.S. Display	Gain**
400.00 mV	400.00 mV	2	400.00	10
40.000 mV	40.000 mV	3	40.000	100
K T.C.	117.65 mV	5	4000.0	34
J T.C.	93.023 mV	6	4000.0	43
T T.C.	45.455 mV	7	4000.0	88

OPTIONAL GAIN CALIBRATIONS

K T.C.	117.65 mV	5 or 6	4000.0	34
J T.C.	93.023 mV	6 or 7	4000.0	43
T T.C.	45.455 mV	4 or 7	4000.0	88
E T.C.	160.00 mV	4 or 5	4000.0	25
S T.C.	40.000 mV	5 or 6	4000.0	100
R T.C.	45.455 mV	4 or 7	4000.0	88
B T.C.	40.000 mV	5	4000.0	100
Custom	+	+	40000+	+

* Instruments without TC's will not contain ranges K, J, & T. These ranges are shown for reference as manufacturing considerations may have dictated a modified placement as shown in "Optional Gain Calibrations". Some TC instruments will not contain all three ranges.

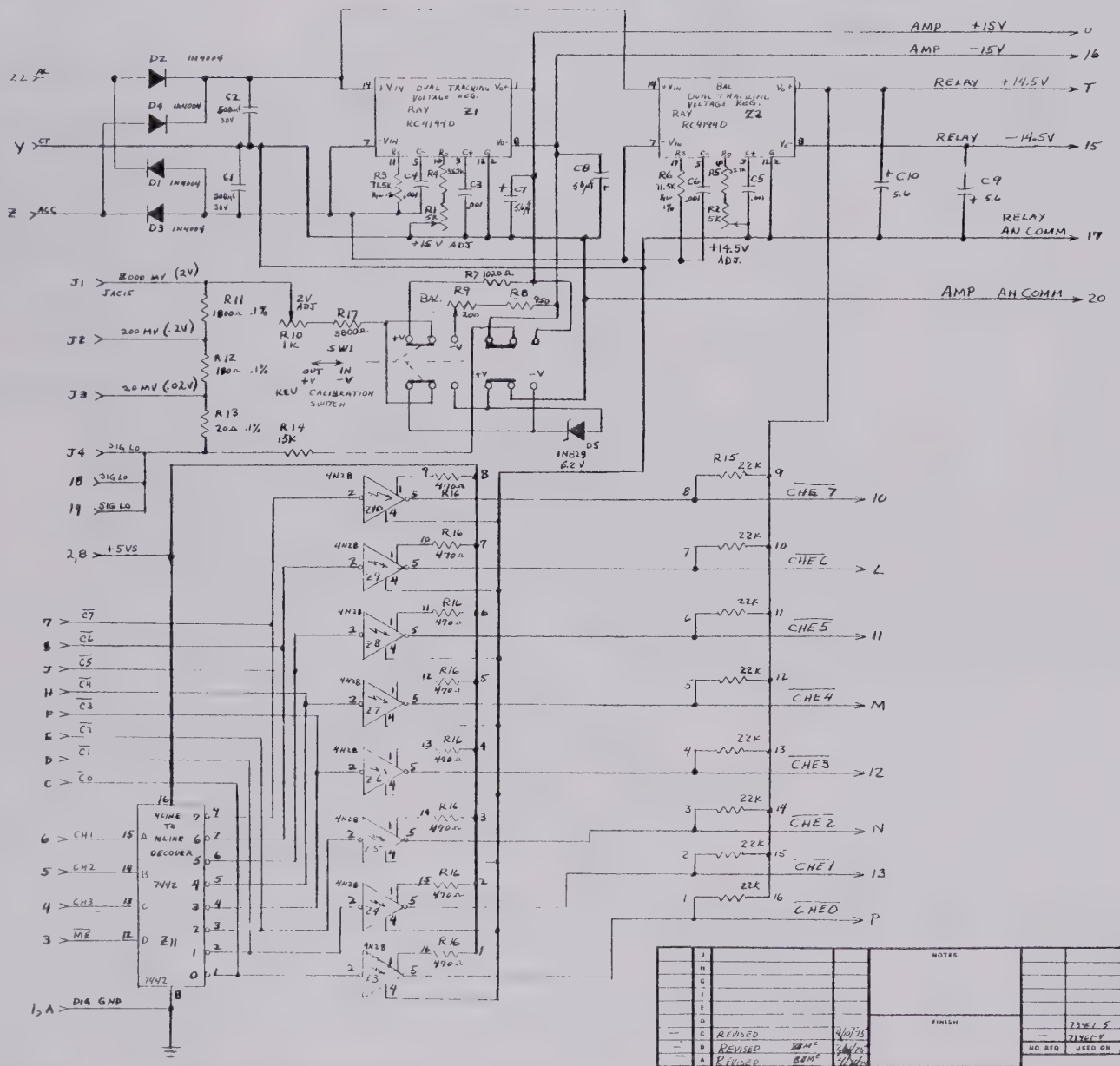
** Shown for reference only. Full Scale Input may be derived from the formula shown below.

\+ Custom gains are used in the design of some instruments. See data sheet for placement. Full scale input voltage may be derived as follows:

$$V\ (f.s.) = \frac{4000.0}{Gain}\ mV$$

Ignoring the decimal point, this will give a display of 40000 counts.

UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSIONS
LENGTH
DIAMETER
2 ECCENTRICITY - NOT TO EXCEED
TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES
AFTER BEING PLATED



734C105

ECN	LET	CHANGE	DATE	RELEASED EPA 5077 4-9-75
	C	REVISED	4/10/75	
	B	REVISED	3/4/75	
	A	REVISED	2/24/75	

NOTES

FINISH

NO. REQ	USED ON	STYLE NO.
	7346L5	
	7346L4	PD2465

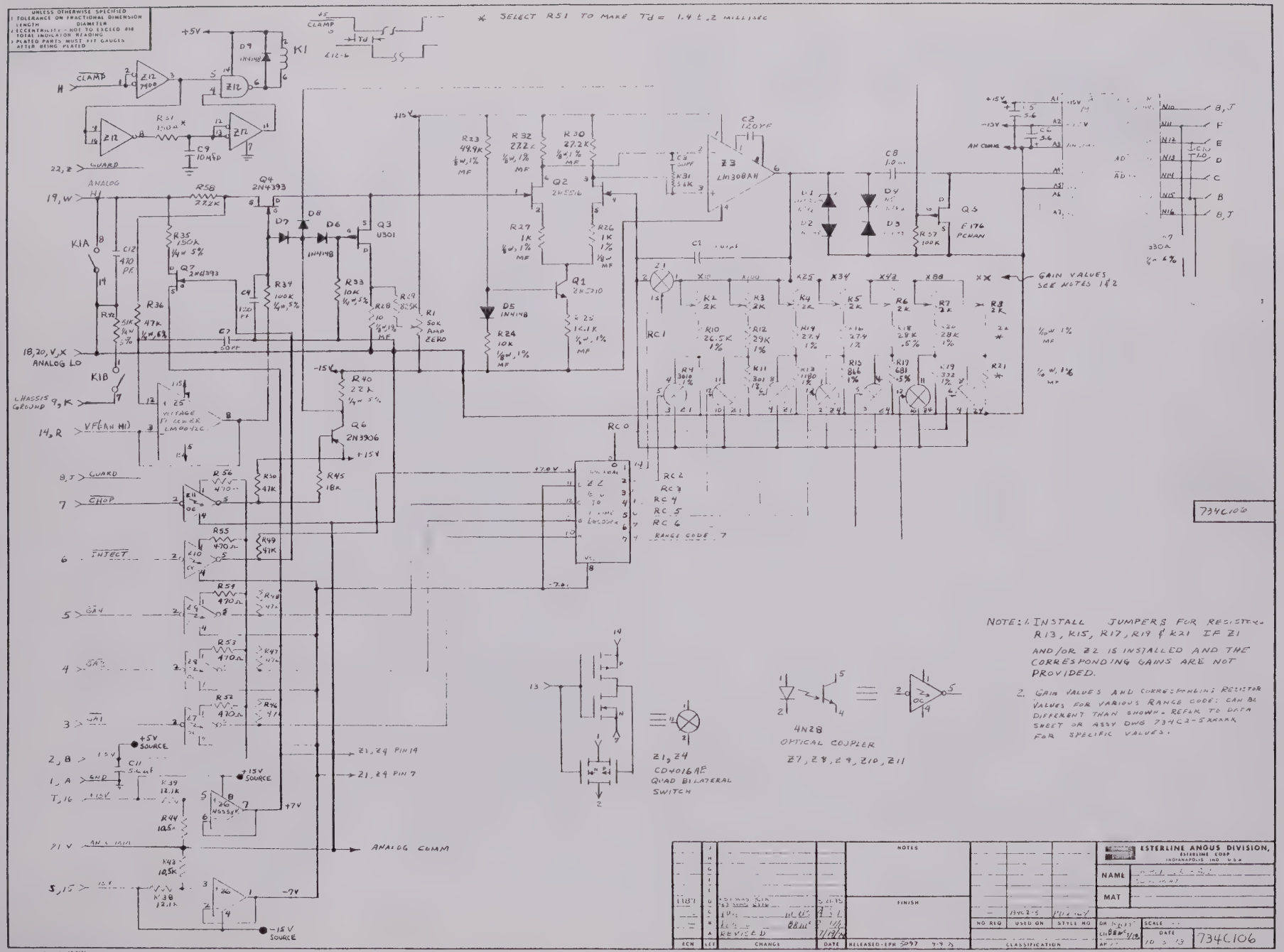
CLASSIFICATION

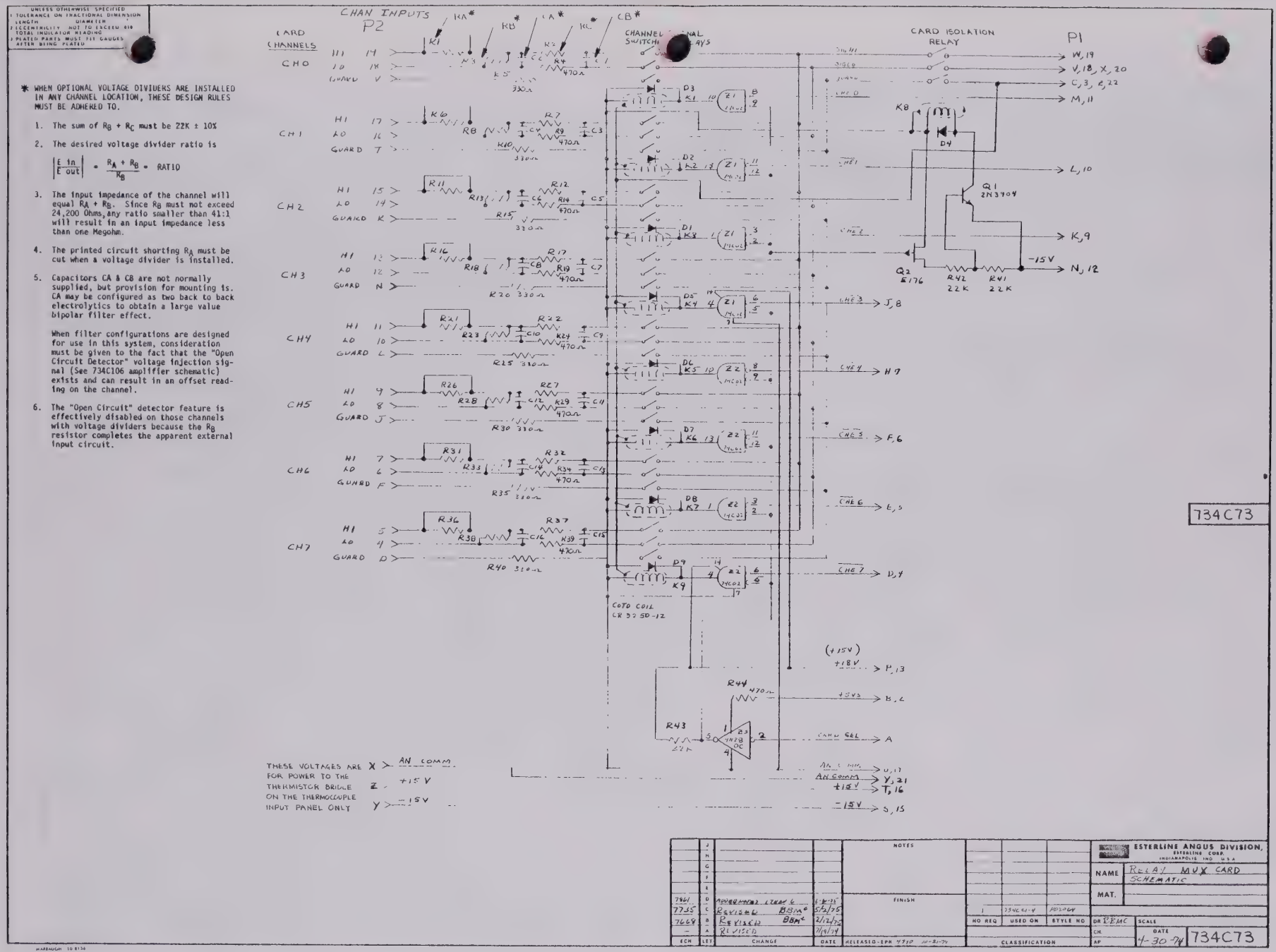
ESTERLINE ANGUS DIVISION, ESTERLINE CORP. INDIANAPOLIS IND. U.S.A.

NAME: CONTROL & POWER SUPPLY
MAT.: SCHEMATIC
DR BBMc
CH.
APP'D
SCALE
DATE 12-10-73

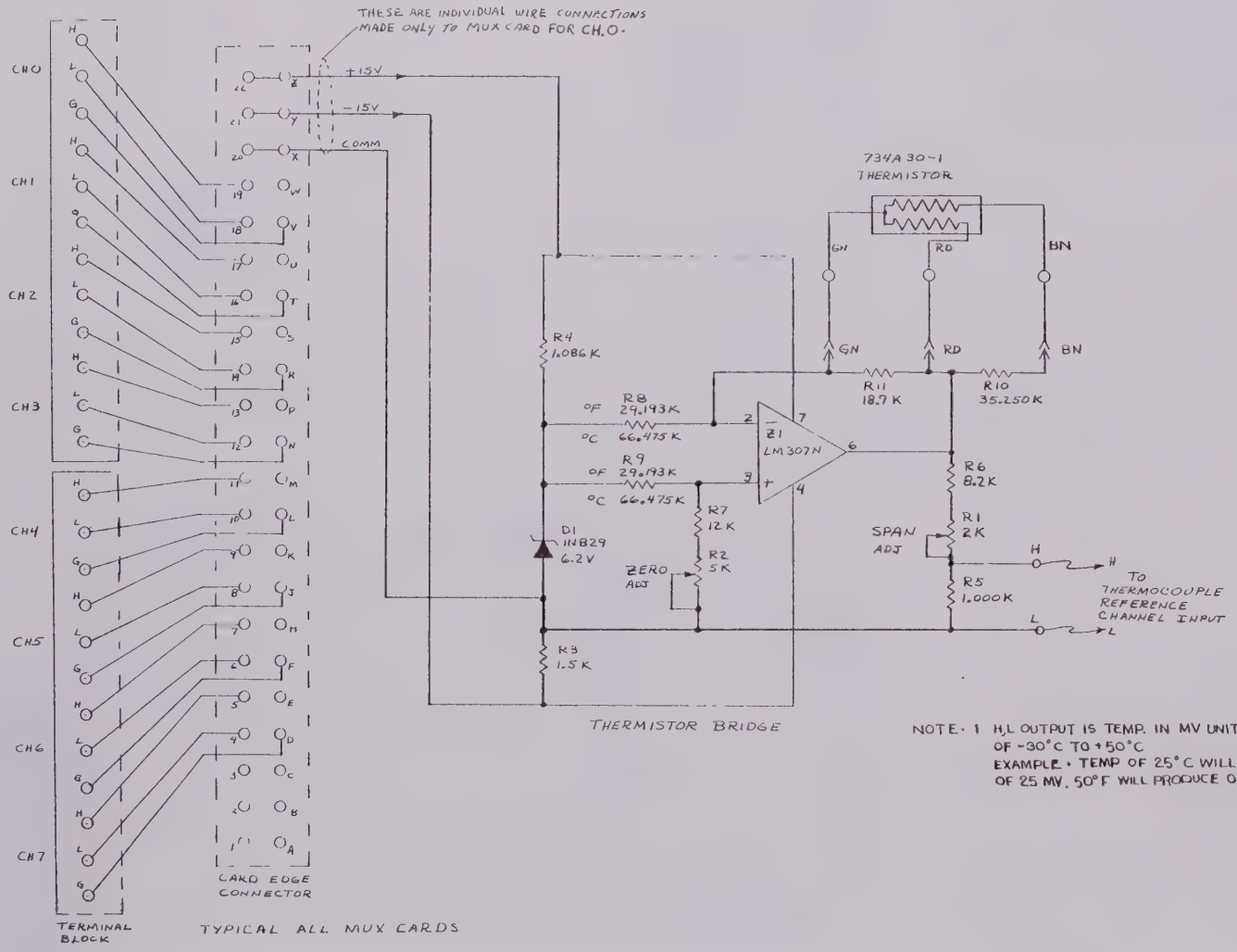
734C105

BLACKHAWK—10 6156


UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH DIAMETER
2 ECCENTRICITY - NOT TO EXCEED .010 TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED
* SELECT RS1 TO MAKE TD = 1.4 ± .2 MILLISEC
+5V
CLAMP
H
K1
D9 1N4148
Z12 7408
R21 1.0M
C9 10MFD
22, Z GUARD
ANALOG HI
19, W
R58 27.2K
Q4 2N4393
K1A
C12 470 PF
R35 150K 1/4W 5%
Q7 2N4393
R36 51K 47K 1/4W 6%
R34 100K 1/4W 5%
C4 .120 PF
C7 .50PF
D8
D7
D6 1N4148
Q3 U301
R33 10K 1/4W 5%
R28 10
R29 8.25K 1/8W 1% MF
R1 50K ANAL ZERO
18, 20, V, X ANALOG LO
K1B
CHASSIS GROUND 9, K
VOLTAGE FT COMP LM004CN
14, R VF(FAN HI)
+15V
R23 49.9K 1/8W, 1% MF
R32 27.2K 1/8W, 1% MF
R30 27.2K 1/8W, 1% MF
Q2 2N5516
R27 1K 1/8W, 1% MF
R26 1K 1% 1/8W MF
Q1 2N3210
D5 1N4148
R24 10K 1/8W, 1% MF
R25 14.1K 1/8W, 1% MF
C3 .047
R31 3.24K
Z3 LM308AH
C2 .120YF
C1 .010MF
-15V
R40 22K 1/4W 5%
Q6 2N3906
R45 18K
R50 47K
8, J GUARD
7 CHOP
R56 470Ω
Z11
R55 470Ω
6 INJECT
R49 47K
R59 470Ω
5 GAIN
R48 47K
R53 470Ω
4 GA2
R47 47K
R52 470Ω
3 GA1
R46 47K
+5V SOURCE
2, B
1, A
T, 16
C11 .01MF
K39 12.1K
+15V SOURCE
Z6 WS554
+7V
R44 10.5K
9, V ANALOG COMM
K43 10.5K
5, 15
K38 12.1K
-7V
-15V SOURCE
ANALOG COMM
Z1, Z4 PIN 19
Z1, Z4 PIN 7
Z1 CLAMP
E12.6
TD
+15V
-15V
AN COMM
C8 1.0 MF
D4
D3
D2
D1
Q5 E176 PCHAN
Z1
X10 X100 X25 X34 X42 X88 XX
K1 2K
K2 2K
K3 2K
K4 2K
K5 2K
K6 2K
K7 2K
K8 2K
GAIN VALUES SEE NOTES 1&2
RC1
R10 26.5K 1%
R12 29K 1%
R14 27.4 1%
R16 28K .5%
R18 28K 1%
R20 28K 1%
R4 3010 1%
K11 301 1%
R13 1180 1%
R15 866 1%
K17 681 .5%
K19 332 1%
R21
1/8W 1% MF
1/8 W, 1% MF
RC0
RC2
RC3
RC4
RC5
RC6
RANGE CODE 7
+7.0V
-7.0V
14
8
A1 A2 A3 A4 A5 A6 A7
N10 N11 N12 N13 N14 N15 N16
8, J
F
E
D
C
B
8, J
330A 1/4W 5%
Z1, Z4
CD4016AE
QUAD BILATERAL SWITCH
4N28
OPTICAL COUPLER
Z7, Z8, Z9, Z10, Z11
NOTE: 1. INSTALL JUMPERS FOR RESISTORS R13, R15, R17, R19 & R21 IF Z1 AND/OR Z2 IS INSTALLED AND THE CORRESPONDING GAINS ARE NOT PROVIDED.
2. GAIN VALUES AND CORRESPONDING RESISTOR VALUES FOR VARIOUS RANGE CODE: CAN BE DIFFERENT THAN SHOWN - REFER TO DATA SHEET OR ASSY DWG 734C2-5XXXXX FOR SPECIFIC VALUES.
734C106
ESTERLINE ANGUS DIVISION, ESTERLINE CORP INDIANAPOLIS IND USA
NAME
MAT
NOTES
FINISH
NO REQ
USED ON
STYLE NO
CLASSIFICATION
ECN
LTR
CHANGE
DATE
RELEASED-EPR 5097 7-9-73
SCALE
DATE
10 5 13
734C106


UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH DIAMETER
2 ECCENTRICITY NOT TO EXCEED .010
TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED
* WHEN OPTIONAL VOLTAGE DIVIDERS ARE INSTALLED IN ANY CHANNEL LOCATION, THESE DESIGN RULES MUST BE ADHERED TO.
1. The sum of RB + RC must be 22K ± 10%
2. The desired voltage divider ratio is
|E in / E out| = (RA + RB) / RB = RATIO
3. The input impedance of the channel will equal RA + RB. Since RB must not exceed 24,200 Ohms, any ratio smaller than 41:1 will result in an input impedance less than one Megohm.
4. The printed circuit shorting RA must be cut when a voltage divider is installed.
5. Capacitors CA & CB are not normally supplied, but provision for mounting is. CA may be configured as two back to back electrolytics to obtain a large value bipolar filter effect.
When filter configurations are designed for use in this system, consideration must be given to the fact that the "Open Circuit Detector" voltage injection signal (See 734C106 amplifier schematic) exists and can result in an offset reading on the channel.
6. The "Open Circuit" detector feature is effectively disabled on those channels with voltage dividers because the RB resistor completes the apparent external input circuit.
CHAN INPUTS
P2
CARD CHANNELS
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
HI
LO
GUARD
RA*
RB*
CA*
RC*
CB*
CHANNEL SIGNAL SWITCHES
CARD ISOLATION RELAY
P1
K8
D4
Q1 2N3704
Q2 E176
-15V
COTO COIL CR 32 SD-12
(+15V)
+18V
+15V
AN COMM
-15V
THESE VOLTAGES ARE FOR POWER TO THE THERMISTOR BRIDGE ON THE THERMOCOUPLE INPUT PANEL ONLY
X > AN COMM
Z > +15V
Y > -15V
734C73
ESTERLINE ANGUS DIVISION
NAME RELAY MUX CARD SCHEMATIC
MAT.
SCALE
DATE 4-30-74
734C73
NOTES
FINISH
CLASSIFICATION
ECN
CHANGE
DATE
RELEASED-EPH 4710 4-30-74

UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH
DIAMETER
2 ECCENTRICITY MUST BE EXCLUDED OUT
TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES
AFTER BEING PLATED



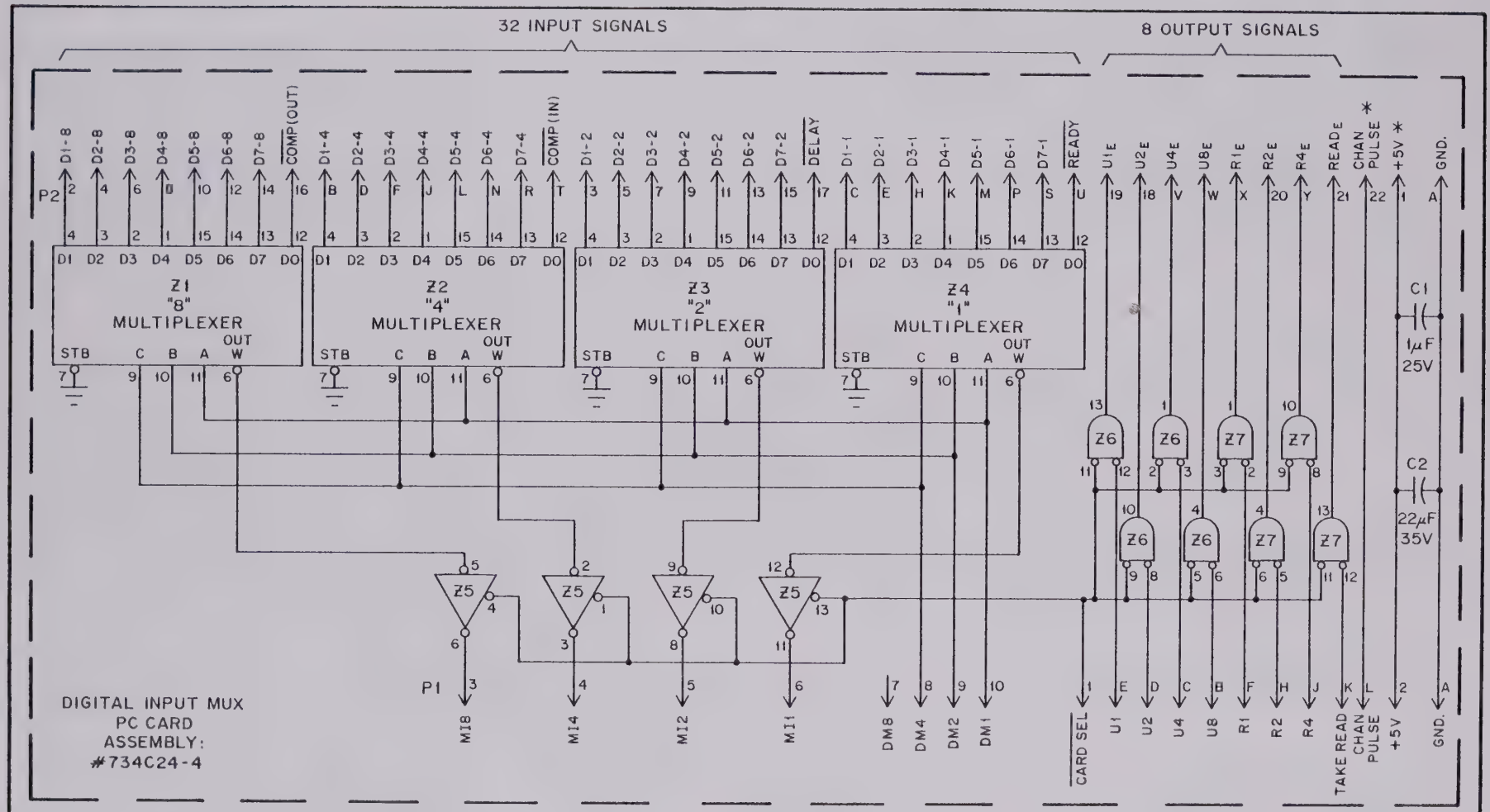
734C71

NOTE: 1 H,L OUTPUT IS TEMP. IN MV UNITS OVER TEMP RANGE OF -30°C TO +50°C
EXAMPLE: TEMP OF 25°C WILL PRODUCE OUTPUT OF 25 MV. 50°F WILL PRODUCE OUTPUT OF 50MV

TYPICAL ALL MUX CARDS

				NOTES			ESTERLINE ANGUS DIVISION, ESTERLINE CORP. INDIANAPOLIS IND. U.S.A.		
							NAME	THERMOCOUPLE MOTHER BOARD SCHEMATIC	
				FINISH			MAT.		
					REF	734D-6D PD2064			
					NO REQ	USED ON STYLE NO	DR BMC	SCALE	
7953		SEE ECN 7953 WHR	9/12/78				CH	DATE 10-17-74	734C71
ECN	LET	CHANGE	DATE	RELEASED-LPR 4965 (LK 4947)		CLASSIFICATION	AP		

MARSHALL-10 8136



POWER WIRING TABLE

I.C./TYPE NO.	+5V PIN	GND PIN
Z1, Z2, Z3, Z4 = SN74151N	16	8
Z5 = SN74125N	14	7
Z6, Z7 = SN7402N	14	7

LEGEND & NOTES:

<3 DENOTES EDGE CONNECTIONS ON PLUG-IN CARD.

⏚ INDICATES CHASSIS GROUND.

1. CAPACITANCE VALUES ARE IN μF (MICROFARADS).

* TEST SIGNAL FOR FACTORY USE ONLY; DO NOT MAKE EXTERNAL CONNECTION TO THIS POINT.

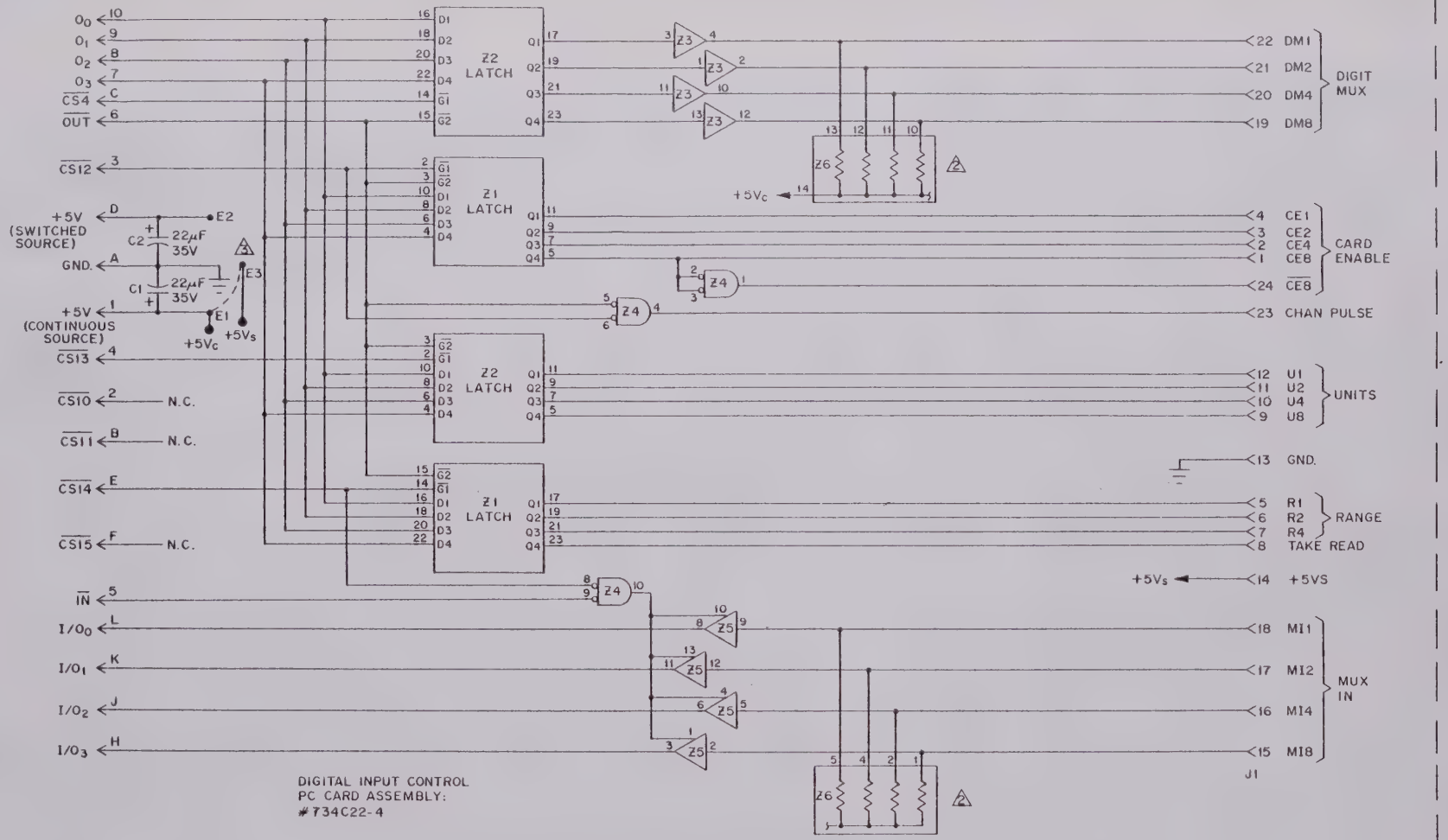
LTR	ECN	DESC OF CHANGE	DATE	CLASSIFICATION
G				
F				
E				
D				
C				734C24-4 / PD2064 (ASSEMBLY NO / MODEL NO)
B				
A	8163	REDRAWN (SEE ECN)	1-15-76	DR P. ROE / DATE DRAWN 2/25/75

ESTERLINE ANGUS
BOX 24000, INDIANAPOLIS, IN. 46224

TITLE: SCHEMATIC: DIGITAL MUX CARD.

REL EPR NO 5248 RELEASE DATE: 1-15-76

FILE NO 734B73



NOTES:

1. CAPACITANCE VALUES ARE IN µF (MICROFARADS).
2. Z6 IS A 14-PIN, DUAL-INLINE RESISTOR NETWORK CONTAINING THIRTEEN 2.2K RESISTORS WITH PIN 14 COMMON (+5V). ONLY 8 RESISTORS ARE CONNECTED.
3. FOR CONTINUOUS SUPPLY OF 5V POWER, JUMPER E3 TO E1; FOR AUTOMATIC ON-OFF OF 5V POWER, JUMPER E3 TO E2.

LEGEND:

10 ← DENOTES EDGE CONNECTIONS ON PLUG-IN CARD.
—<1 INDICATES PINS IN 24-PIN DIP SOCKET.
N.C. = NO CONNECTION.

LEGEND:

DENOTES CHASSIS GROUND.
•E3 DENOTES JUMPER PADS ON PC CARD.

POWER WIRING TABLE

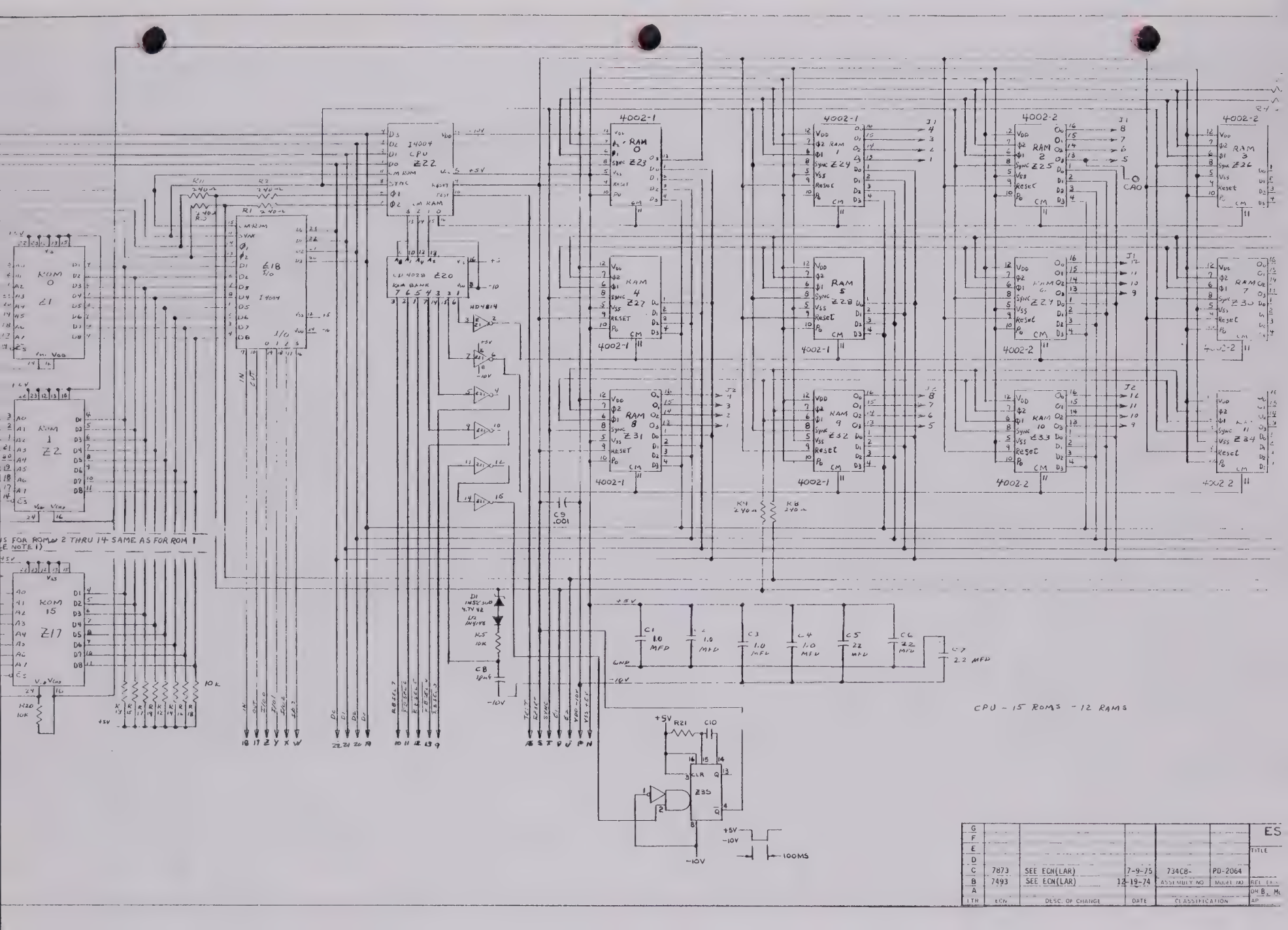
I.C. TYPE NO	+5Vc PIN	+5Vs PIN	GND. PIN
Z1, Z2 = SN74116N	-	24	12
Z3 = SN7417N	-	14	7
Z4 = SN7402	14	-	7
Z5 = SN74126N	14	-	7

LTR	ECN	DESC OF CHANGE	DATE	ASSEMBLY NO	MODEL NO
G					
F					
E					
D					
C				734C22-4	PD2064
B					
A	8163	REDRAWN (SEE ECN)	1 15 76		

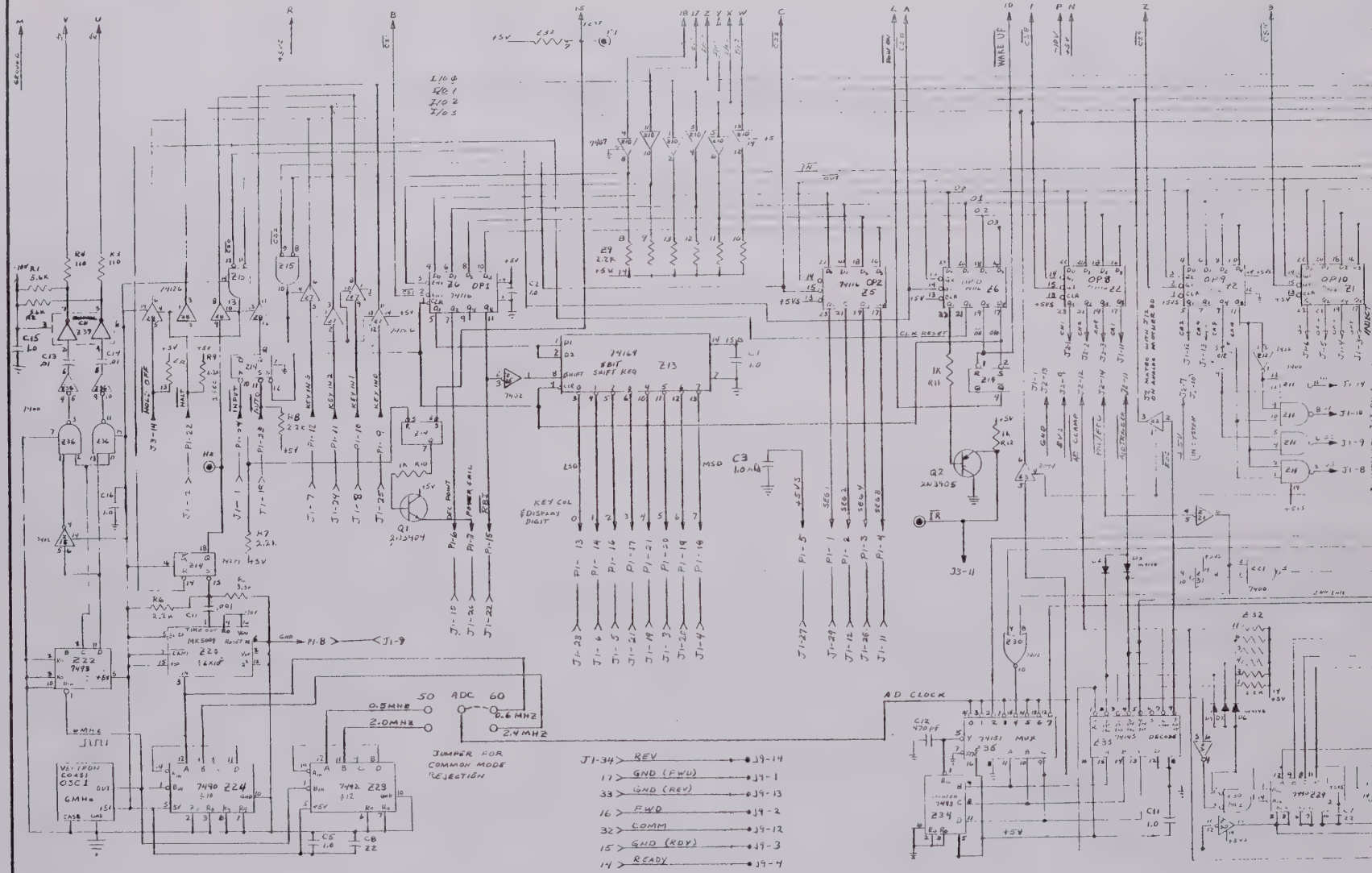
ESTERLINE ANGUS
BOX 24000, INDIANAPOLIS, IN. 46224

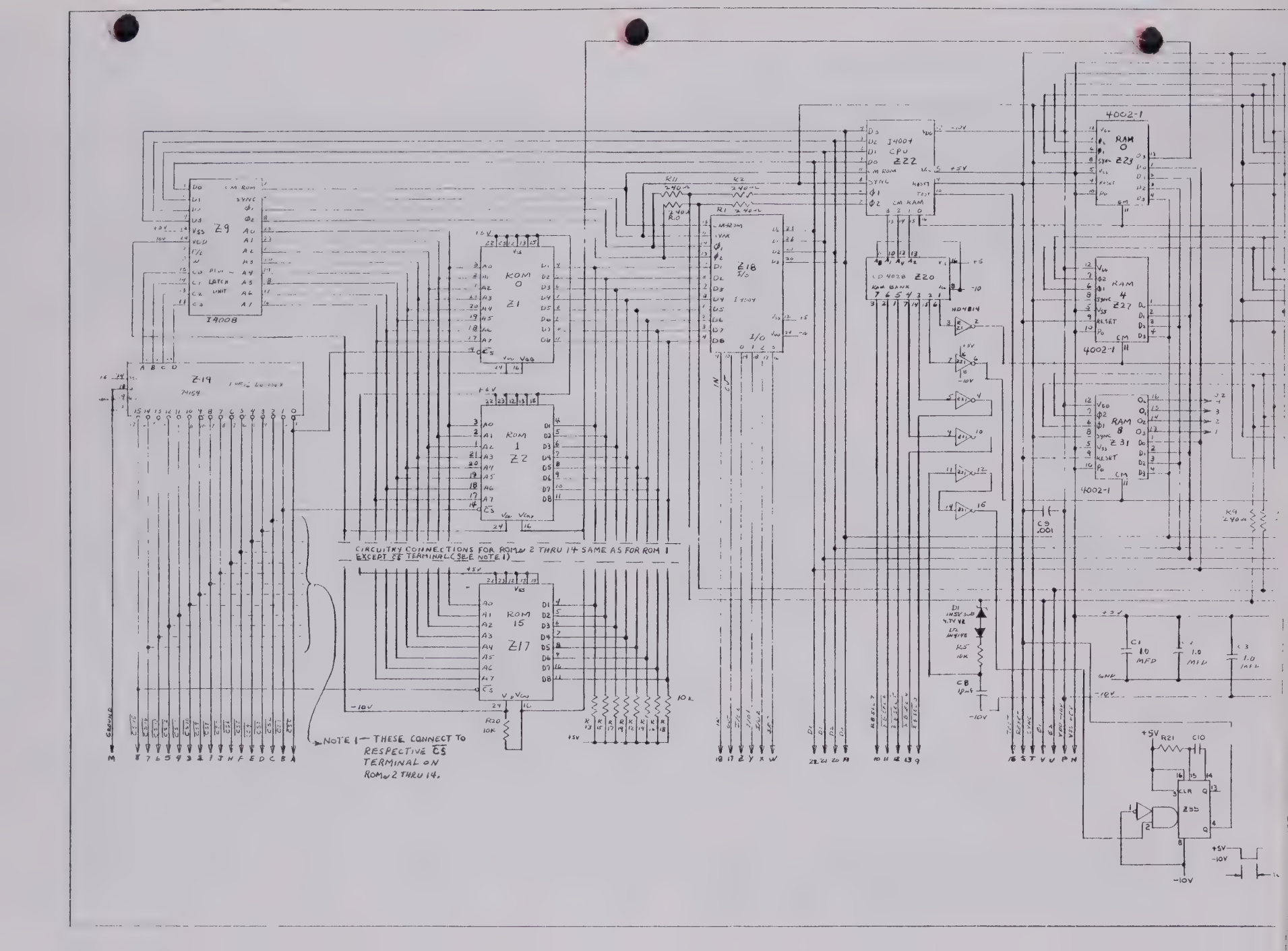
TITLE: *DIGITAL INPUT CONTROL CARD SCHEMATIC*

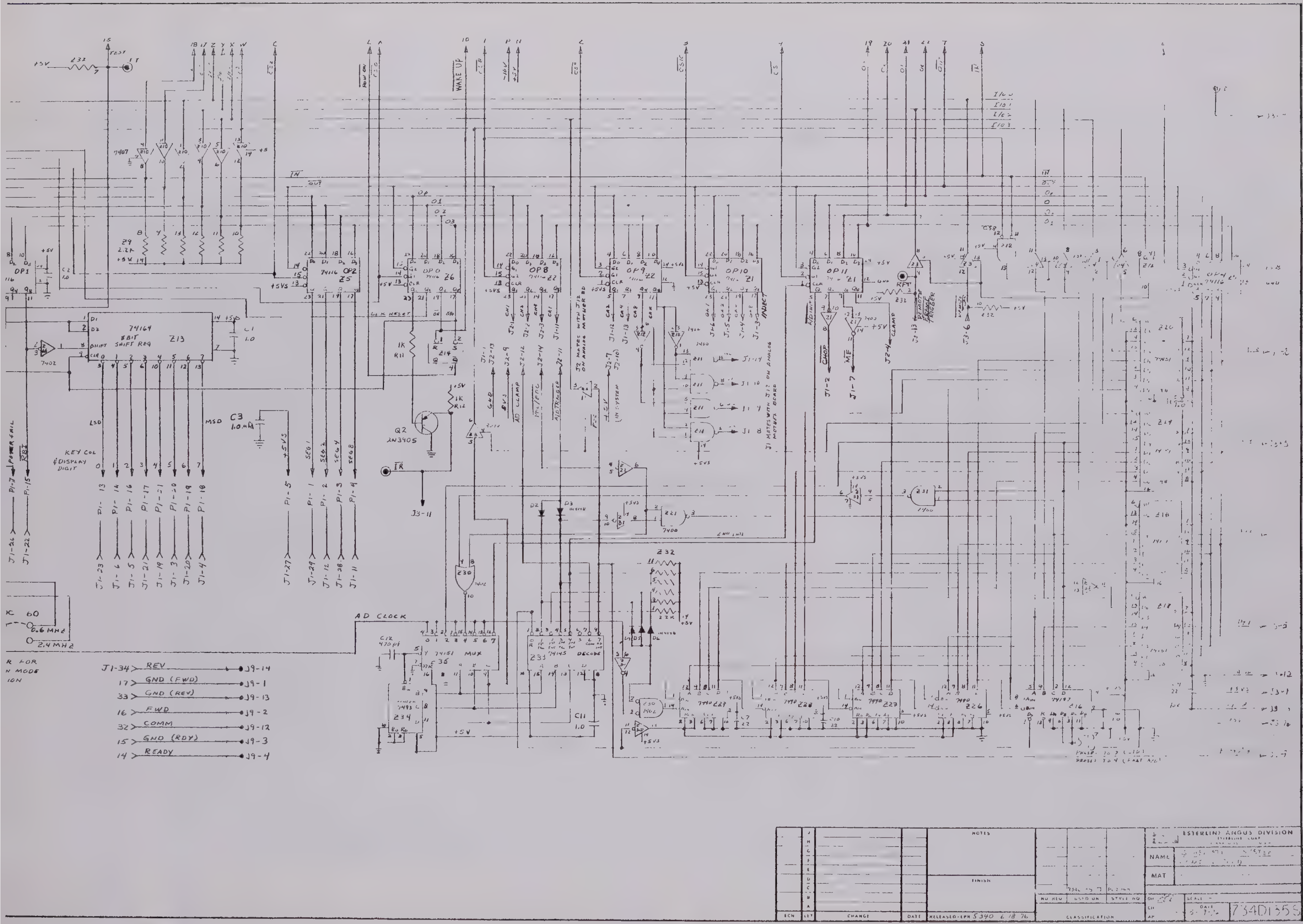
NEXT ASSY NO. 5248 RELEASE DATE 1-15-76
DR P. ROE DATE DRAWN 2-27-75 FILE NO 734C129



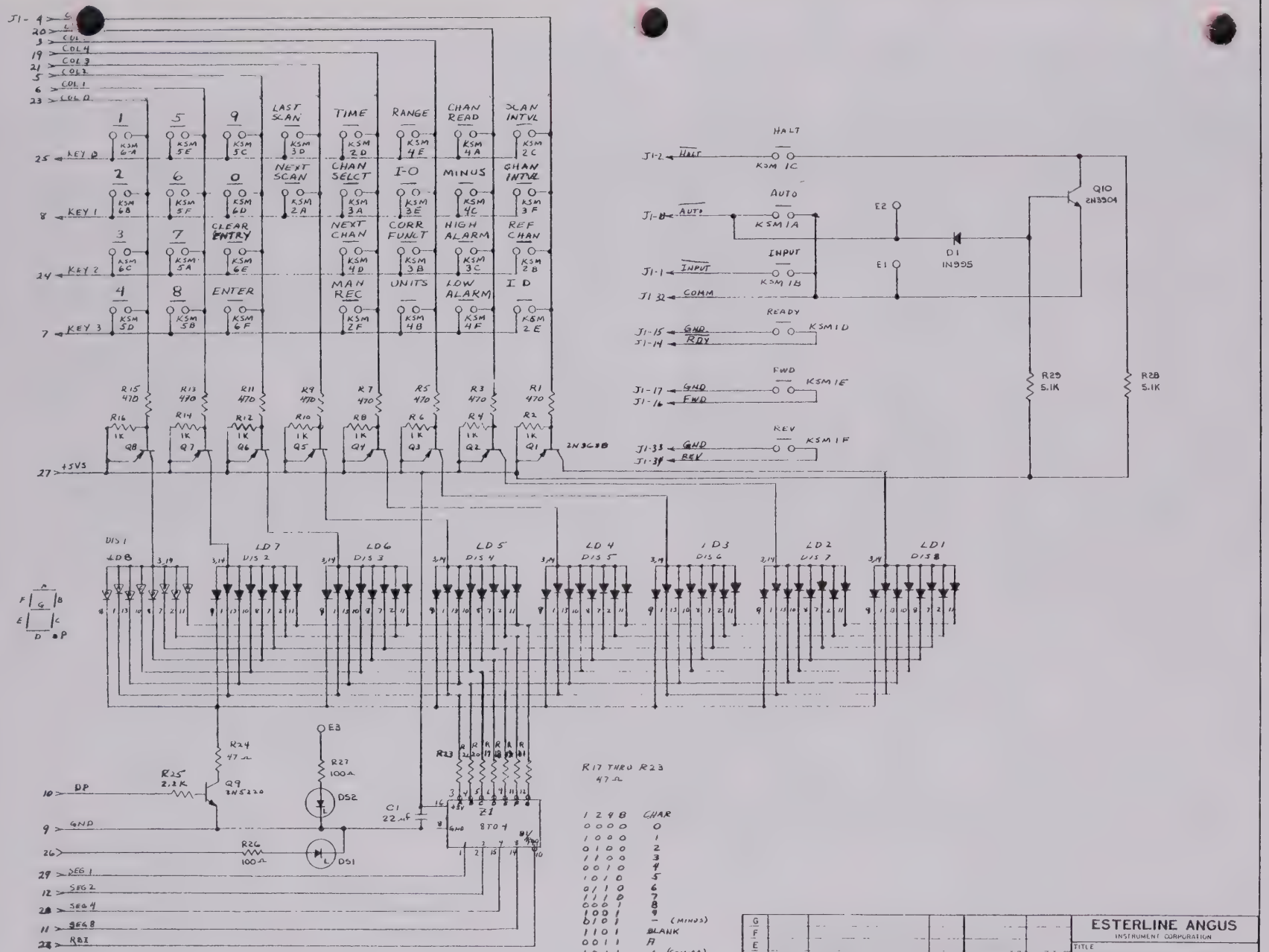
G							ES
F							
E							TITLE
D							
C	7873	SEE ECN(LAR)	7-9-75	7348B-	PD-2064		
B	7493	SEE ECN(LAR)	12-19-74	ASSEMBLY NO	MODEL NO	REL EX	
A						DR B. M	
ITR	ECN	DESC. OF CHANGE	DATE	CLASSIFICATION		AP	


WIRE PADS FOR JUMPER CONNECTIONS
REMOVABLE WIRE CONNECTION TERMINAL ON PC CARD
J1 IS SCOTCH FLEX SOCKET TO KEYBOARD
J1 IS 14 PIN DIP SOCKET TO J13 ON ANALOG MOTHER BOARD
J2 IS 14 PIN DIP SOCKET TO J12 ON ANALOG MOTHER BOARD
J3 IS 16 PIN DIP SOCKET TO REAR PANEL REMOTE CONTROL CONNECTOR(IF USED)
J9 IS SCOTCH FLEX CONNECTOR TO DIGITAL MOTHER BOARD
P1 IS SCOTCH FLEX CONNECTOR TO CABLE 734C133-
JUMPER FOR COMMON MODE REJECTION
J1-34 > REV
17 > GND (FWD)
33 > GND (REV)
16 > FWD
32 > COMM
15 > GND (RDY)
14 > READY
AD CLOCK
WAKE UP
74164 8 BIT SHIFT SHIFT REG
74116
74107
74123
74132
74151 MUX
74192
74193
74221
74283
74298
74373
74374
74393
74400
74H228
MK5009
2N3904
2N3905
VECTRON CO-81 OSC 1
6MHz
0.5MHz
2.0MHz
0.6 MHz
2.4MHz
50 ADC 60
+5V
+5VS
+15V
-15V
GROUND
KEY COL (DISPLAY DIGIT)
LSD
MSD


4002-1
RAM 0 Z23
RAM 4 Z27
RAM 8 Z31
4002-1
4002-1
4002-1
I4008
Z9
Z19
74154
1 of 16 decoder
ROM 0 Z1
ROM 1 Z2
ROM 15 Z17
I4004 CPU Z22
I/O Z18
I/O
LD 4028 Z20
RAM BANK
HD-4814
Z55
CIRCUITRY CONNECTIONS FOR ROMs 2 THRU 14 SAME AS FOR ROM 1 EXCEPT CS TERMINAL (SEE NOTE 1)
NOTE 1 — THESE CONNECT TO RESPECTIVE CS TERMINAL ON ROMs 2 THRU 14.
GROUND
+5V
-10V
-12V
-18V
GND
C1 1.0 MFD
C2 1.0 MIL
C3 1.0 MIL
C5 .001
C8 10MF
C10
R11 2.40K
R20 10K
R21
D1 IN5711 OR 1N914 OR IN4148
CS .001



74164
8 BIT SHIFT REG
Z13
KEY COL & DISPLAY DIGIT
LSD
MSD
C3 1.0 mfd
OP1
OP2 Z5
OP0 Z6
OP8
OP9 Z2
OP10 Z1
OP11 Z1
WAKE UP
POW ON
SEG 1
SEG 2
SEG 4
SEG 8
Q2 2N3905
1K R11
1K R12
J3-11
GND
AD CLAMP
A/D TRIGGER
CHOP
ME
CLAMP
REMOTE TRIGGER
J1 MATES WITH J12 ON ANALOG MOTHER BOARD
J2 MATES WITH J12 ON ANALOG MOTHER BD
Z32
AD CLOCK
74151 MUX
74145 DECODE
Z33
Z34
C11 1.0
C12 470 pf
0.6 MHz
2.4 MHz
J1-34 REV J9-14
17 GND (FWD) J9-1
33 GND (REV) J9-13
16 FWD J9-2
32 COMM J9-12
15 GND (RDY) J9-3
14 READY J9-4
ESTERLINE ANGUS DIVISION
NAME
MAT
NOTES
FINISH
CHANGE
DATE
RELEASED-EPN 5340 6 18 76
CLASSIFICATION
734D1555



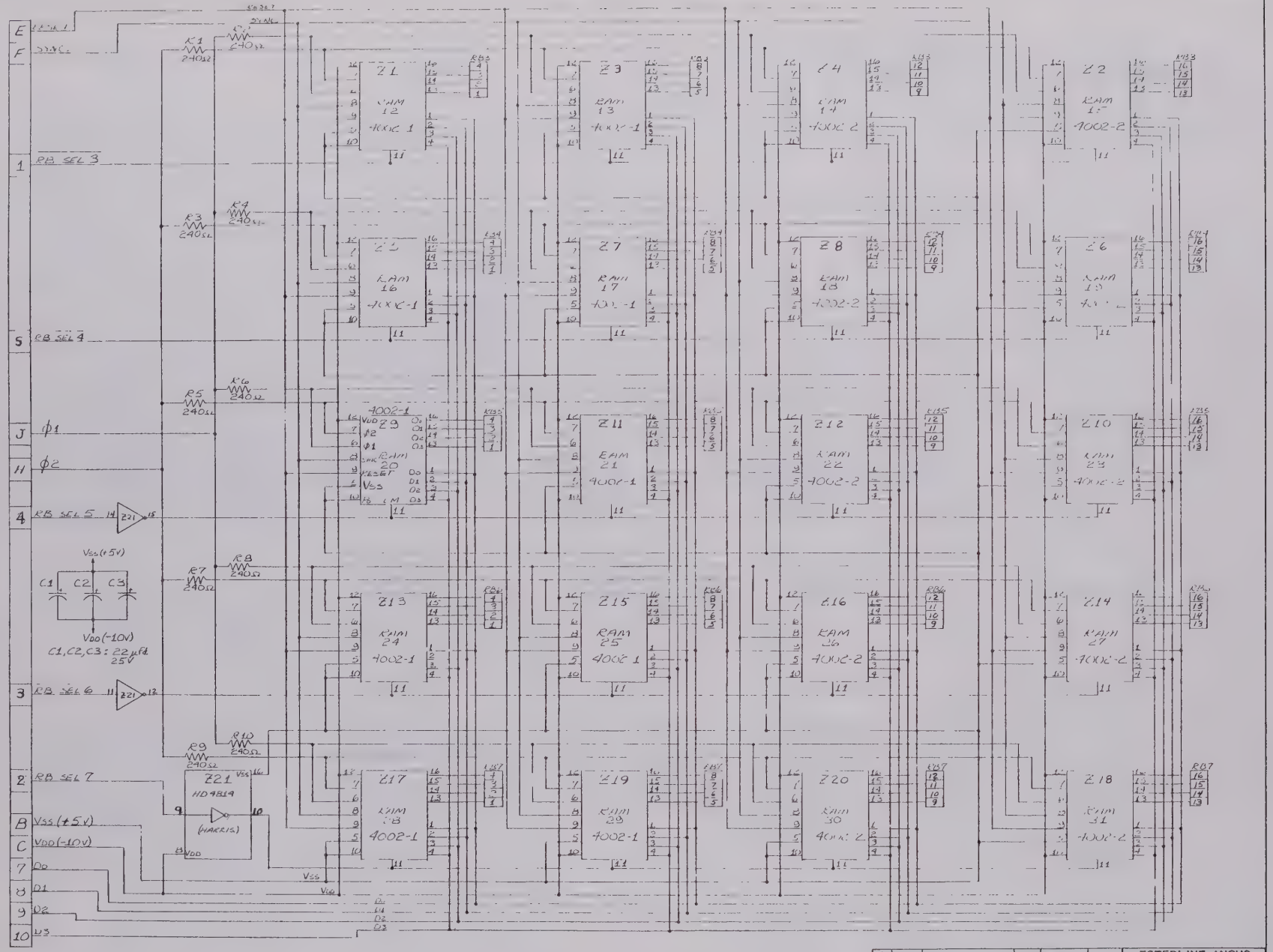
1 2 4 8	CHAR
0 0 0 0	0
1 0 0 0	1
0 1 0 0	2
1 1 0 0	3
0 0 1 0	4
1 0 1 0	5
0 1 1 0	6
1 1 1 0	7
0 0 0 1	8
1 0 0 1	9
0 1 0 1	- (MINUS)
1 1 0 1	BLANK
0 0 1 1	A
1 0 1 1	, (COMMA)
0 1 1 1	L
1 1 1 1	BLANK

LTR	ECN	DESC OF CHANGE	DATE	CLASSIFICATION	
G					
F					
E					
D					
C	B385	SEE ECN	6-21-76	734C20-4	PD-2064
B	8226	SEE ECN	3-2-76	ASSEMBLY NO.	MODEL NO.
A	8070	SEE ECN	10-30-75		

ESTERLINE ANGUS
INSTRUMENT CORPORATION

TITLE
KEYBOARD AND DISPLAY SCHEMATIC

REL. SPR. NO. 4980 RELEASE DATE 11-4-74
DRB. MCC DATE DRAWN 10-21-74 FILE NO. 734C72
AP

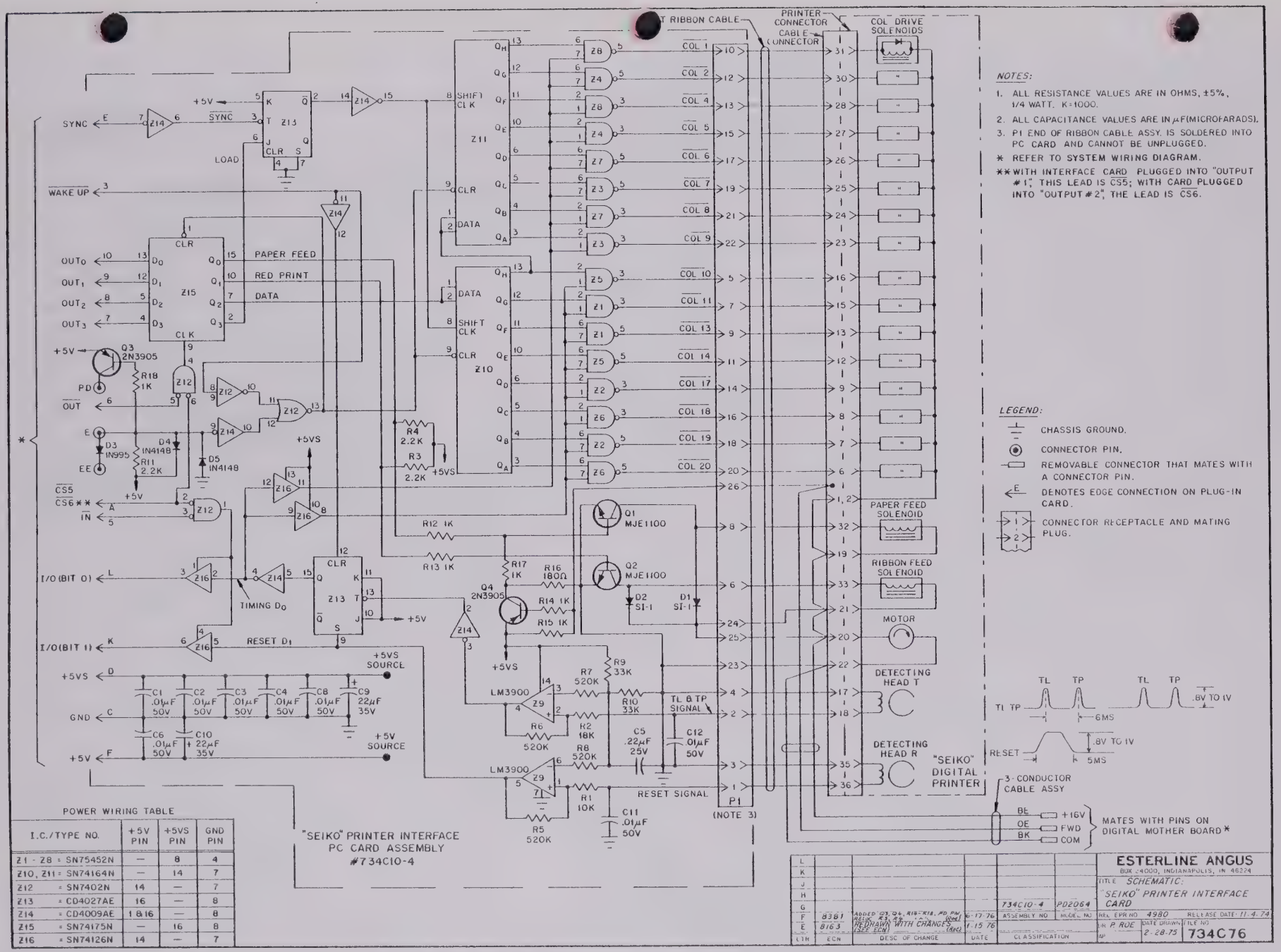


LTR	ECN	DESC OF CHANGE	DATE	CLASSIFICATION
B	7494	SEE ECN	12-20-74	734C11- ASSEMBLY NO / PD-2064 MICRO NO

ESTERLINE ANGUS
INSTRUMENT CORPORATION

TITLE: RAM EXPANSION CARD SCHEMATIC

SIZE: D | CAD NO: 4981 | RELEASE DATE: 11-6-74
DRAWN BY: TDP | DATE DRAWING RELEASED: 10-2-73
APP: | 734D22



NOTES:

1. ALL RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 WATT. K=1000.
2. ALL CAPACITANCE VALUES ARE IN μF(MICROFARADS).
3. P1 END OF RIBBON CABLE ASSY. IS SOLDERED INTO PC CARD AND CANNOT BE UNPLUGGED.

* REFER TO SYSTEM WIRING DIAGRAM.

** WITH INTERFACE CARD PLUGGED INTO "OUTPUT #1", THIS LEAD IS $\overline{CS5}$; WITH CARD PLUGGED INTO "OUTPUT #2", THE LEAD IS $\overline{CS6}$.

LEGEND:

- CHASSIS GROUND.
- CONNECTOR PIN.
- REMOVABLE CONNECTOR THAT MATES WITH A CONNECTOR PIN.
- E — DENOTES EDGE CONNECTION ON PLUG-IN CARD.
- CONNECTOR RECEPTACLE AND MATING PLUG.

POWER WIRING TABLE

I.C./TYPE NO.	+5V PIN	+5VS PIN	GND PIN
Z1 - Z8 = SN75452N	—	8	4
Z10, Z11 = SN74164N	—	14	7
Z12 = SN7402N	14	—	7
Z13 = CD4027AE	16	—	8
Z14 = CD4009AE	1 & 16	—	8
Z15 = SN74175N	—	16	8
Z16 = SN74126N	14	—	7

"SEIKO" PRINTER INTERFACE PC CARD ASSEMBLY #734C10-4

LTR	ECN	DESC OF CHANGE	DATE
G			
F	8381	ADDED Q3, Q4, R18-R18, PD PIN REVISE R3, R4, R5 ADDED R6, R7, R8 REDRAWN WITH CHANGES (SEE ECN)	6-17-76
E	8163		1-15-76

734C10-4 | PD2064 | ASSEMBLY NO | MODEL NO

CLASSIFICATION

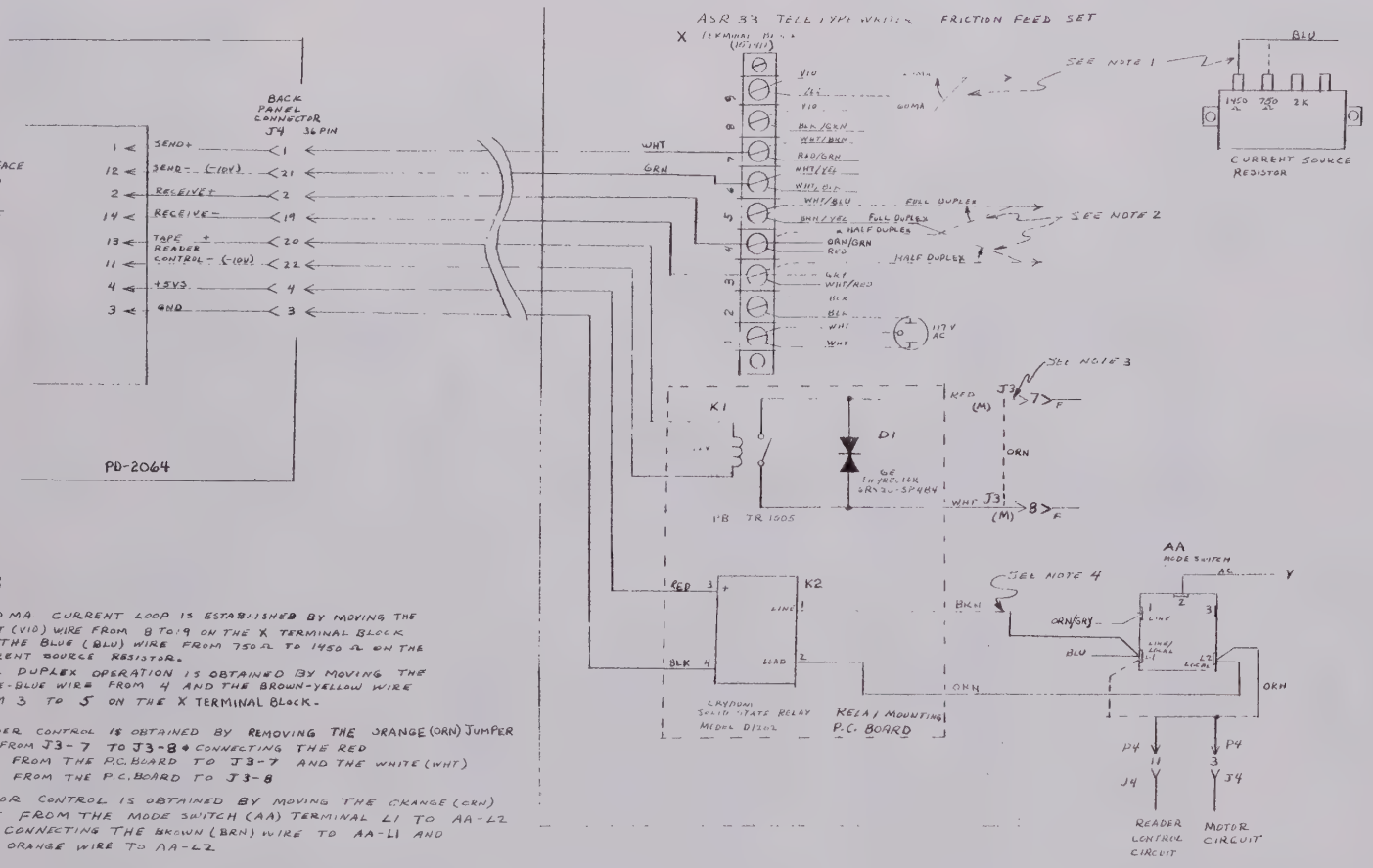
ESTERLINE ANGUS
BOX 24000, INDIANAPOLIS, IN 46224

TITLE SCHEMATIC: "SEIKO" PRINTER INTERFACE CARD

REL EPR NO 4980 | RELEASE DATE 11-4-74

DRAWN P. RUE | DATE DRAWN 2-28-75 | FILE NO 734C76

UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH
DIAMETER
2 ECCENTRICITY - NOT TO EXCEED .010 TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED



NOTES:

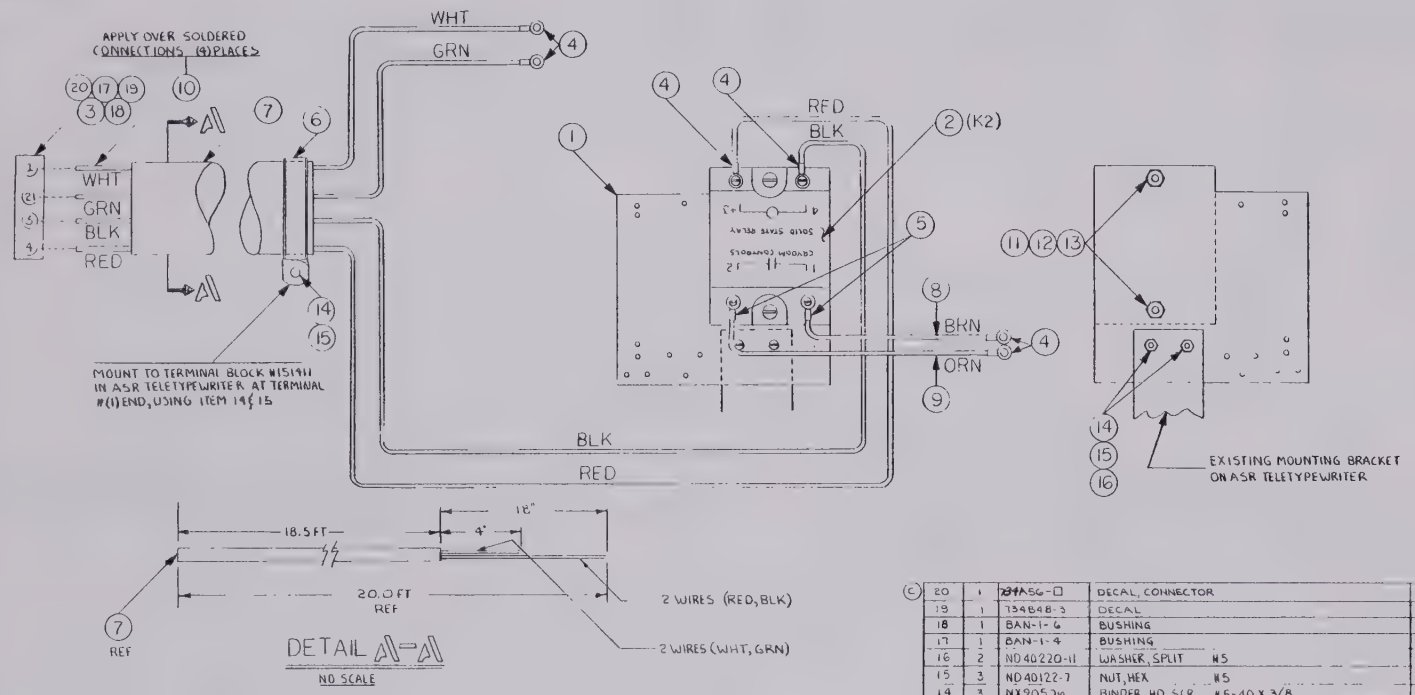
1. A 20 MA. CURRENT LOOP IS ESTABLISHED BY MOVING THE VIOLET (VIO) WIRE FROM 8 TO 9 ON THE X TERMINAL BLOCK AND THE BLUE (BLU) WIRE FROM 750 Ω TO 1450 Ω ON THE CURRENT SOURCE RESISTOR.
2. FULL DUPLEX OPERATION IS OBTAINED BY MOVING THE WHITE-BLUE WIRE FROM 4 AND THE BROWN-YELLOW WIRE FROM 3 TO 5 ON THE X TERMINAL BLOCK.
3. READER CONTROL IS OBTAINED BY REMOVING THE ORANGE (ORN) JUMPER WIRE FROM J3-7 TO J3-8 & CONNECTING THE RED WIRE FROM THE P.C. BOARD TO J3-7 AND THE WHITE (WHT) WIRE FROM THE P.C. BOARD TO J3-8
4. MOTOR CONTROL IS OBTAINED BY MOVING THE ORANGE (ORN) WIRE FROM THE MODE SWITCH (AA) TERMINAL L1 TO AA-L2 AND CONNECTING THE BROWN (BRN) WIRE TO AA-L1 AND THE ORANGE WIRE TO AA-L2.
5. INSTALL THE RELAY MOUNTING BOARD USING ITEMS 14, 15, AND 16 AS SHOWN ON DRAWING # 734C68-2.

734C78

				NOTES				ESTERLINE ANGUS DIVISION, ESTERLINE CORP. INDIANAPOLIS IND U.S.A.	
								NAME	PD2064 TO ASR33 TTY INTER CONNECTION DIAGRAM
				FINISH				MAT.	
						1	734R1	PD2064	
						NO REQ	USED ON	STYLE NO	
LCN	LET	CHANGE	DATE	RELEASED-EPR 9/1/81 10:14 PM		CLASSIFICATION		DR BEM	SCALE
								CH	DATE 8/28/81
								AP	734C78

MARBAUGH—10 8/56

UNLESS OTHERWISE SPECIFIED
1. TOLERANCE ON FRACTIONAL DIMENSION
   LENGTH
   DIAMETER
2. ECCENTRICITY - NUT TO EXCEED 010 TOTAL INDICATOR READING
3. PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED



DETAIL A→A
NO SCALE

734C68-2

	ITEM NO	QTY	EA PART NO	DESCRIPTION	REMARKS
(C)	20	1	731A56-□	DECAL, CONNECTOR	SEE NOTE 2
	19	1	734B48-3	DECAL	
	18	1	BAN-1-6	BUSHING	
	17	1	BAN-1-4	BUSHING	
	16	2	ND40220-11	WASHER, SPLIT #5	
	15	3	ND40122-7	NUT, HEX #5	
	14	3	NX9053G	BINDER HD SCR., #5-40 X 3/8	
	13	2	ND40220-14	WASHER, SPLIT #8	
	12	2	NX2108	NUT, HEX #8-32	
	11	2	NX9080G	BINDER HD SCR., #8-32 X 3/8	
	10	4	0260	SHRINK TUBING BLACK # 3/32	1/2 IN.
	9	1	0771	WIRE, INSULATED ORANGE # 22 (7X30)	6 IN.
	8	1	0774	WIRE, INSULATED BROWN # 22 (7X30)	6 IN.
	7	1	01583	CABLE, 4 CONDUCTOR # 22 (7X30)	200 FT.
	6	1	ND40081-002	CLAMP, CABLE	
	5	2	ND40031-2	LUG, TERMINAL #8	
	4	6	ND40031-3	LUG, TERMINAL #6	
	3	1	KBR3-30360	PLUG, 36PIN W/COVER	
	2	1	REL25	RELAY, SOLID STATE	K2
	1	1	734C68-1	TTY CONVERSION BOARD	

NOTE:
1. FOR SCHEMATIC, SEE DWG 734C78
(C) 2. ATTACH APPROPRIATE DASH NO. OF ITEM 20 TO CONNECTOR HOOD TO IDENTIFY CONNECTION TO REAR PANEL OF PD2064 AND EXPANDER BOX(S). SEE DWG 734C118 INTERCONNECTION CABLE DIAGRAM

LTR	CHANGE	DATE
C	ADDED ITEM 20 & NOTE 2	10-22-75
B	ADDED ITEM 19	9-5-75
A	ADDED ITEMS 17 & 18	3-12-75
ECN	RELEASED-ERR 4941	9-27-74

NOTES
734C68-1 TTY CONV. BOARD
734C68-2 TTY CONV. BOARD WRITE ONLY ASSY

FINISH

NO REQ	USED ON	STYLE NO
1	734R1	PD2064

CLASSIFICATION

ESTERLINE ANGUS DIVISION, ESTERLINE CORP INDIANAPOLIS IND U.S.A.

NAME: TTY CONVERSION BOARD WRITE ONLY ASSY
MAT:
DR G.G.
CH
AP Bogle
SCALE NONE
DATE 9-23-74
734C68-2

POWER WIRING TABLE

I.C./TYPE NO.	+5V PIN	GND. PIN
Z1 = SN7402N	14	7
Z2 = SN7475N	16	8
Z3 = SN74126N	14	7

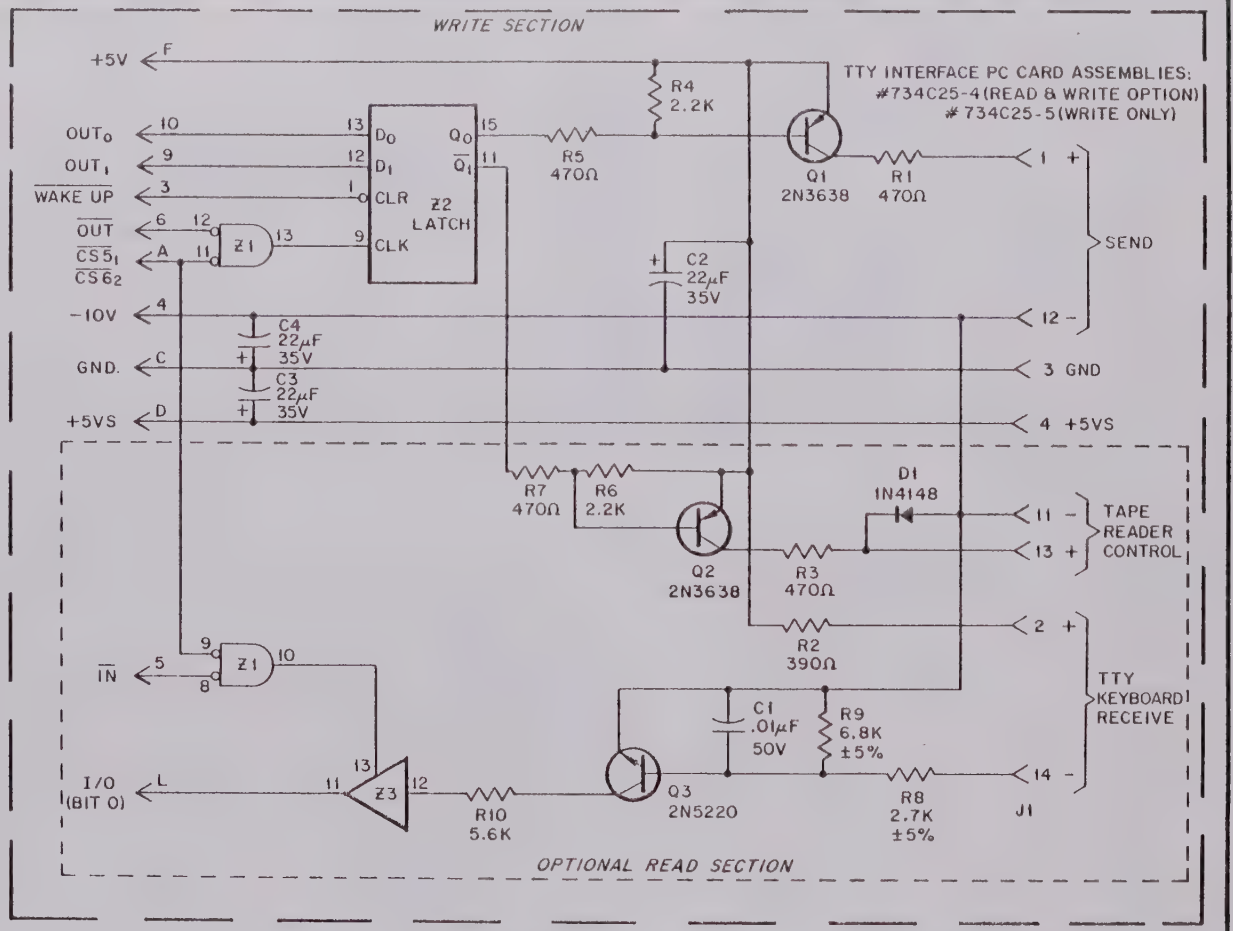
NOTES:

1. COMPONENTS SHOWN WITHIN DASHED ENCLOSURE (READ SECTION) ARE OMITTED IN "WRITE ONLY" ASSEMBLIES.
2. UNLESS OTHERWISE NOTED, ALL RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 WATT; K = 1000.
3. CAPACITANCE VALUES ARE IN μF (MICROFARADS).

LEGEND:

←F DENOTES EDGE CONNECTIONS ON PLUG-IN CARD.

—<1 INDICATES CONNECTOR PINS IN 14-PIN DIP SOCKET.



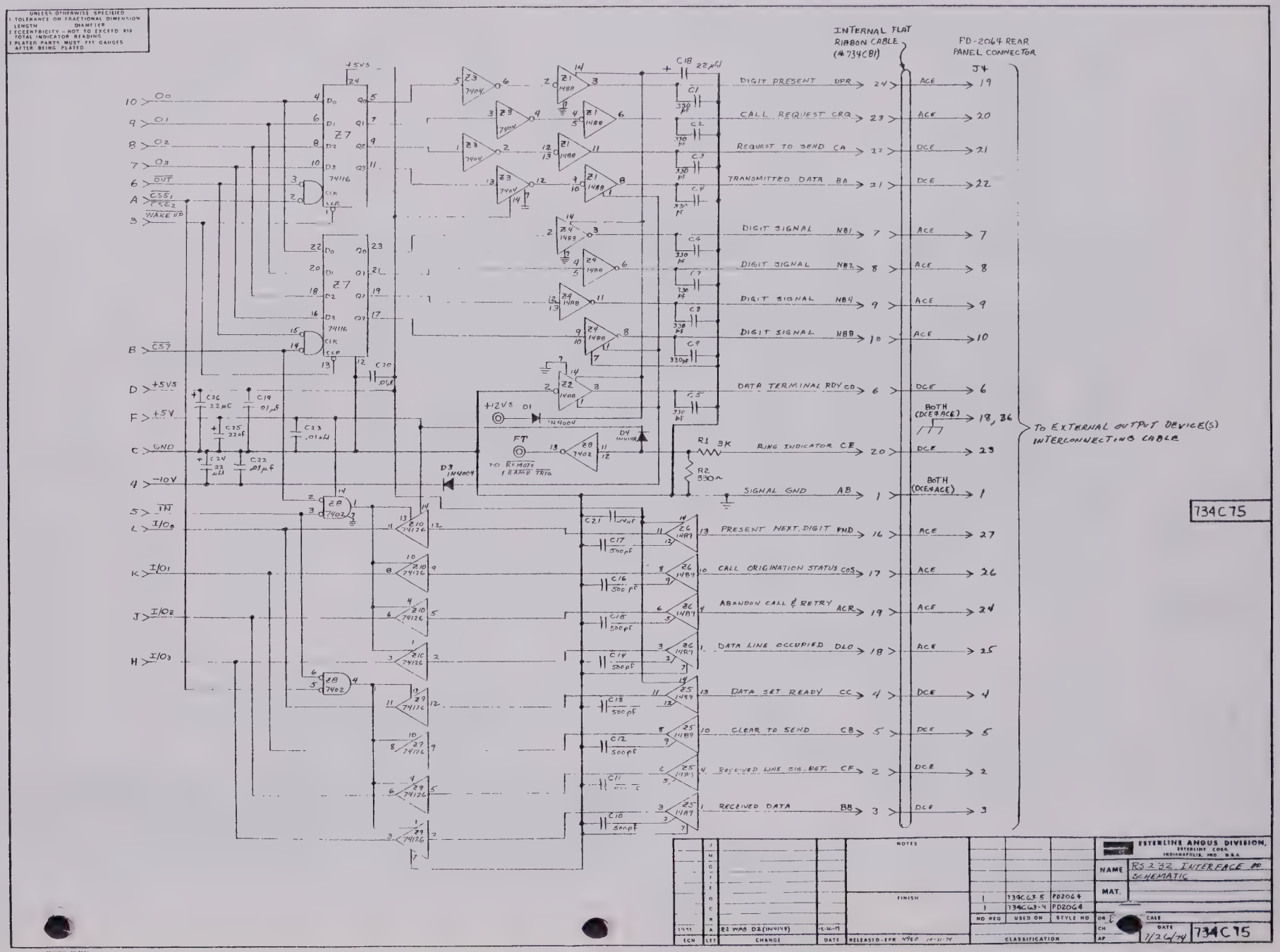
LTR	ECN	DESC. OF CHANGE	DATE	ASSEMBLY NO.	MODEL NO.
G					
F					
E					
D				734C25-4	PD2064
C				734C25-5	PD2064
B					
A	8163	REDRAWN (SEE ECN)	1-15-76		

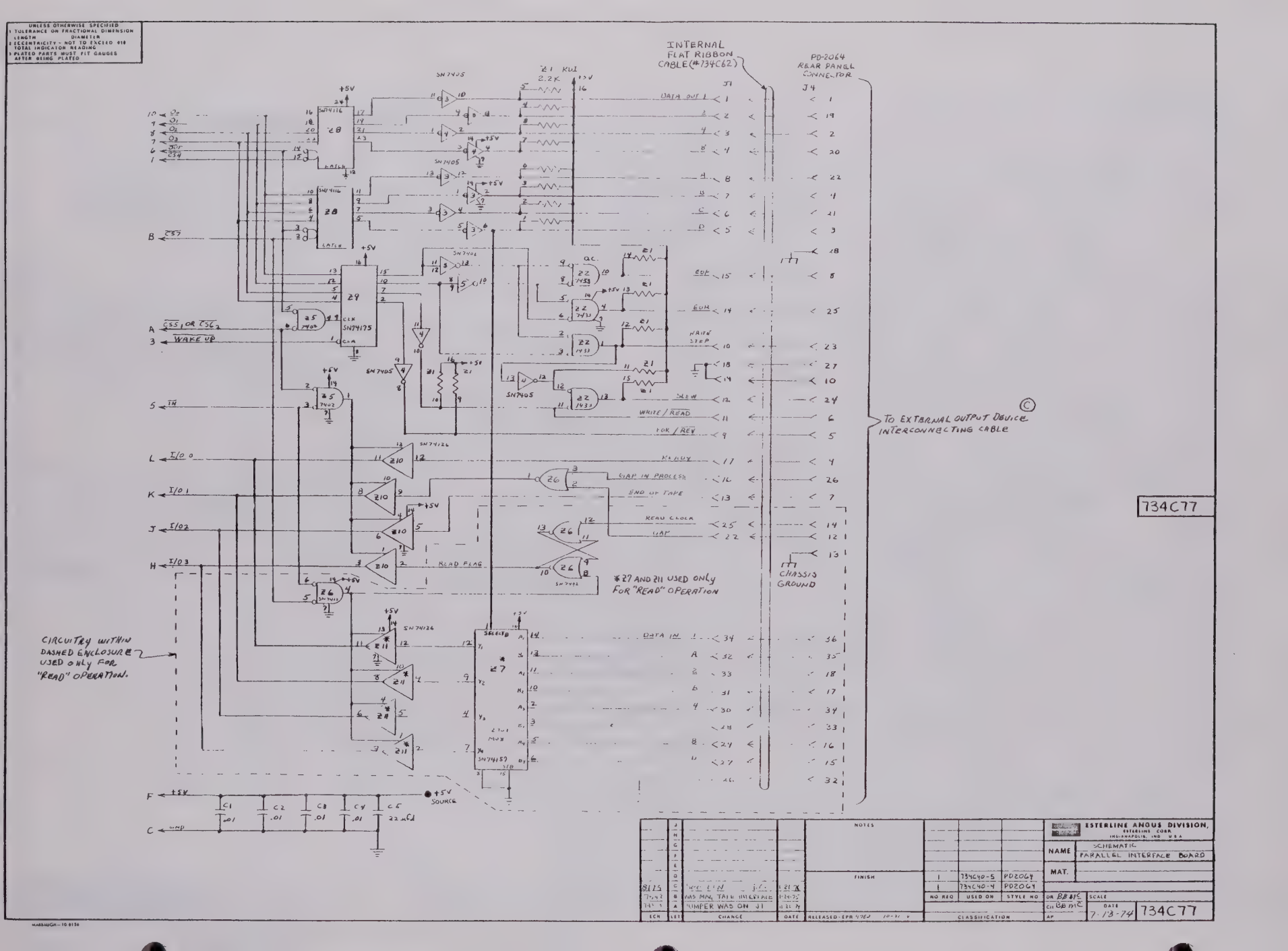
CLASSIFICATION

ESTERLINE ANGUS
BOX 24000, INDIANAPOLIS, IN. 46224

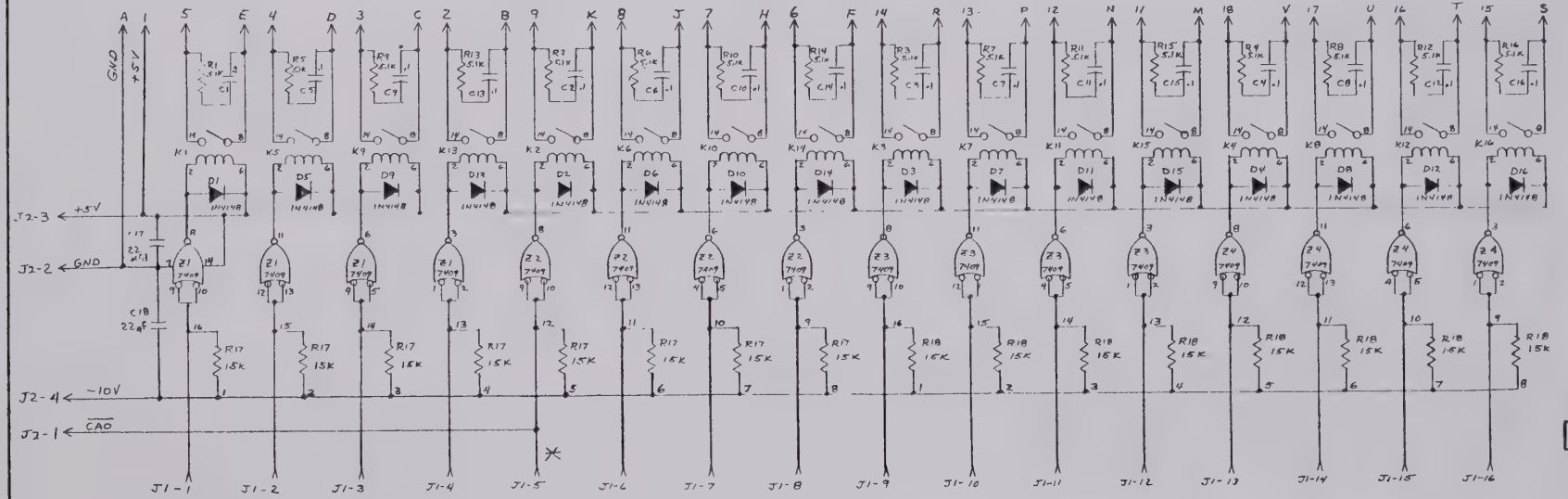
TITLE: SCHEMATIC: TTY INTERFACE CARD.

REL. EPR NO. 5248 RELEASE DATE: 1/15/76
DR P. ROE DATE DRAWN 2-26-75 FILE NO. 734B74
AP.


UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH DIAMETER
2 ECCENTRICITY – NOT TO EXCEED .010 TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED
INTERNAL FLAT RIBBON CABLE (#734CB1)
FD-2064 REAR PANEL CONNECTOR
J4
+5VS
+12VS
+5V
GND
-10V
DIGIT PRESENT DPR
CALL REQUEST CRQ
REQUEST TO SEND CA
TRANSMITTED DATA BA
DIGIT SIGNAL NB1
DIGIT SIGNAL NB2
DIGIT SIGNAL NB4
DIGIT SIGNAL NB8
DATA TERMINAL RDY CD
RING INDICATOR CE
SIGNAL GND AB
PRESENT NEXT DIGIT PND
CALL ORIGINATION STATUS COS
ABANDON CALL & RETRY ACR
DATA LINE OCCUPIED DLO
DATA SET READY CC
CLEAR TO SEND CB
RECEIVED LINE SIG. DET. CF
RECEIVED DATA BB
TO EXTERNAL OUTPUT DEVICE(S) INTERCONNECTING CABLE
734C75
ESTERLINE ANGUS DIVISION
INDIANAPOLIS, IND. U.S.A.
NAME RS 232 INTERFACE PD SCHEMATIC
MAT.
DR
CH
AP
DATE 7/26/74
734C75
ECN 1441
A R2 WAS D2 (IN4149)
CHANGE
NOTES
FINISH
734C63-5 PD2064
734C63-4 PD2064
NO REQ
USED ON
STYLE NO
CLASSIFICATION


UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH DIAMETER
2 ECCENTRICITY - NOT TO EXCEED .010 TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED
INTERNAL FLAT RIBBON CABLE (#734C62)
PD-2064 REAR PANEL CONNECTOR
J1
J4
TO EXTERNAL OUTPUT DEVICE INTERCONNECTING CABLE
CIRCUITRY WITHIN DASHED ENCLOSURE USED ONLY FOR "READ" OPERATION.
*27 AND 211 USED ONLY FOR "READ" OPERATION
CHASSIS GROUND
+5V SOURCE
DATA OUT 1
DATA IN
GAP IN PROCESS
END OF TAPE
READ CLOCK
WAKE UP
WRITE / READ
FOR / REV
734C77
ESTERLINE ANGUS DIVISION
SCHEMATIC
PARALLEL INTERFACE BOARD
734C40-5 PD2064
734C40-4 PD2064
7-18-74
734C77

UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH DIAMETER
2 ECCENTRICITY - NOT TO EXCEED .010 TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED



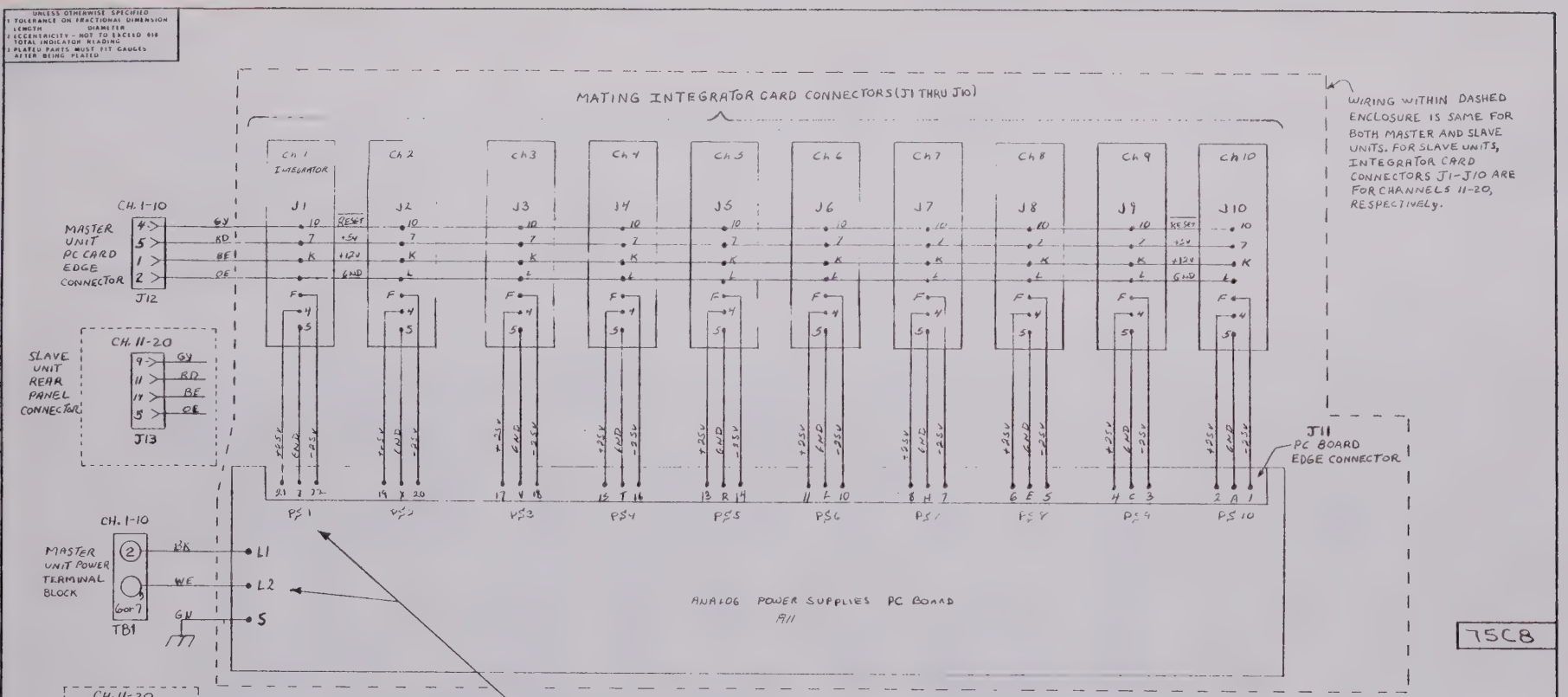
734C74

✳ CUT LEAD AT J1-5 (WIRING SIDE OF PC BOARD) WHEN A 734C67-5 (HIGH HALF & COMMON) ASSEMBLY IS USED IN A 72 CHANNEL ALARM SYSTEM.

IMPORTANT DIODES MAY HAVE REFERENCE DESIGNATION PREFIX OF 'D' OR 'CR'

ECN 1697	LET A	CHANGE UPDATE BMK	DATE 3-21-75	NOTES			ESTERLINE ANGUS DIVISION, ESTERLINE CORP INDIANAPOLIS IND U.S.A.	
				FINISH			NAME	OUTPUT RELAY BOARD SCHEMATIC
							MAT	
					NO REQ	734C67 USED ON	PD2064 STYLE NO	DR BBM CH AP
				RELEASED-EPR 4984 M-31-74		CLASSIFICATION		DATE 8/13/74 734C74

UNLESS OTHERWISE SPECIFIED
1 TOLERANCE ON FRACTIONAL DIMENSION
LENGTH DIAMETER
2 ECCENTRICITY - NOT TO EXCEED .010 TOTAL INDICATOR READING
3 PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED



75C8

POWER SUPPLY COMPONENTS FOR P.S. #1 THRU P.S. #10 ON P.C. BOARD A11

COMPONENT ↓	POWER SUPPLY NUMBERS									
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
CAPACITORS	C11, C12	C1, C2	C13, C14	C3, C4	C15, C16	C6, C5	C8, C7	C17, C18	C10, C9	C19 C20
RECTIFIERS	CR11, CR12	CR1, CR2	CR13, CR14	CR3, CR4	CR15, CR16	CR5, CR6	CR7, CR8	CR17, CR18	CR9 CR10	CR19 CR20
TRANSFORMER	T6	T1	T7	T2	T8	T3	T4	T9	T5	T10

FOR POWER SUPPLY & CONTROL SCHEMATIC, SEE DRAWING # 75C1-S

FOR INTEGRATOR CARD SCHEMATIC, SEE DRAWING # 75C4-□-□

ECN	LET	CHANGE	DATE	RELEASED-EPN
8175	A	SEE ECN	T.C. 1-23-76	5059

NOTES

FINISH

NO REQ	USED ON	STYLE NO
	75D1-2	SLAVE
	75D1-1	MASTER
PD2964	INTEGRATOR	

CLASSIFICATION

ESTERLINE ANGUS DIVISION, ESTERLINE CORP. INDIANAPOLIS IND. U.S.A.

NAME PD2064 GUARD BOX (ANALOG POWER SUPPLY WIRING DIAGRAM)

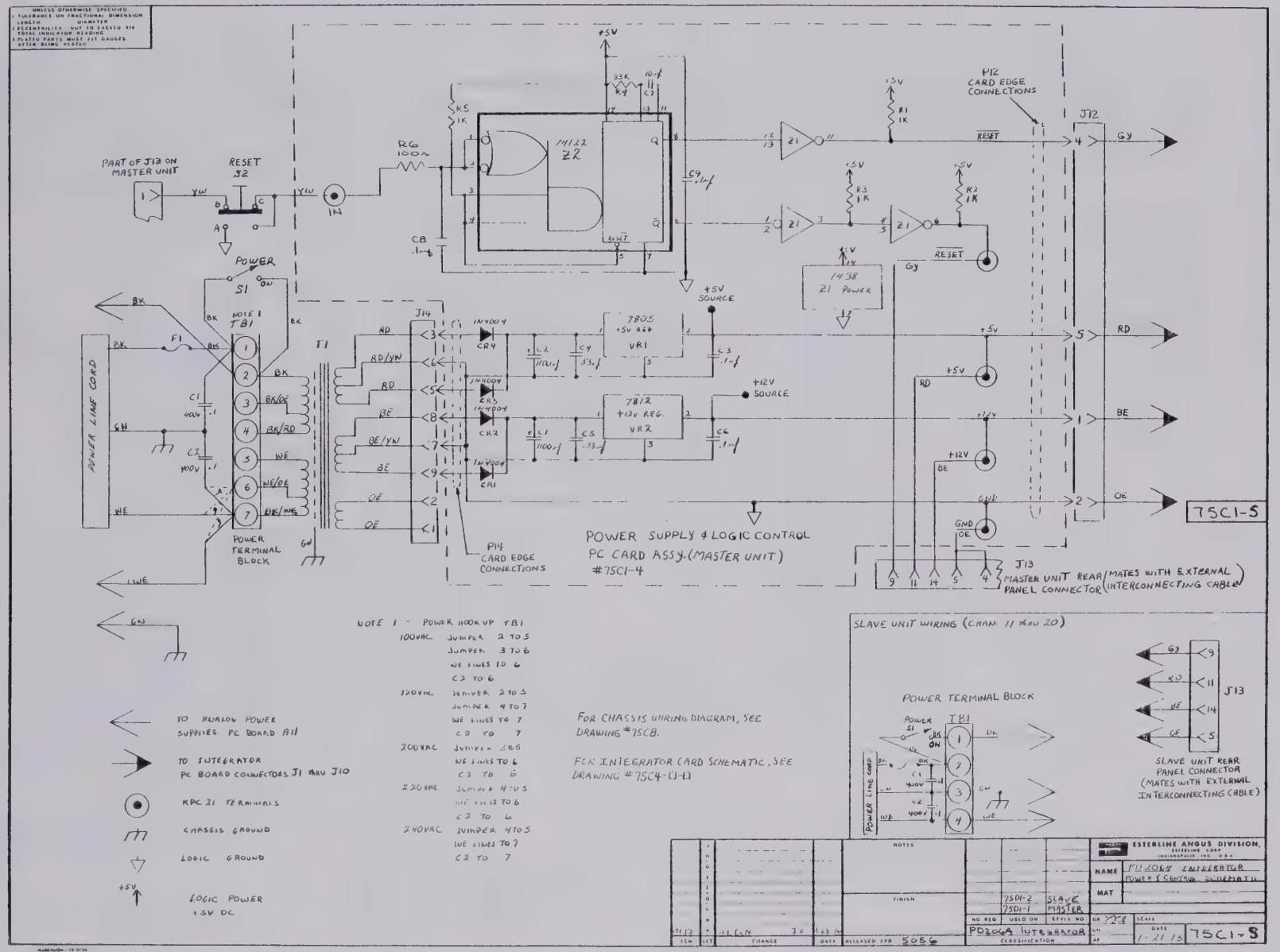
MAT

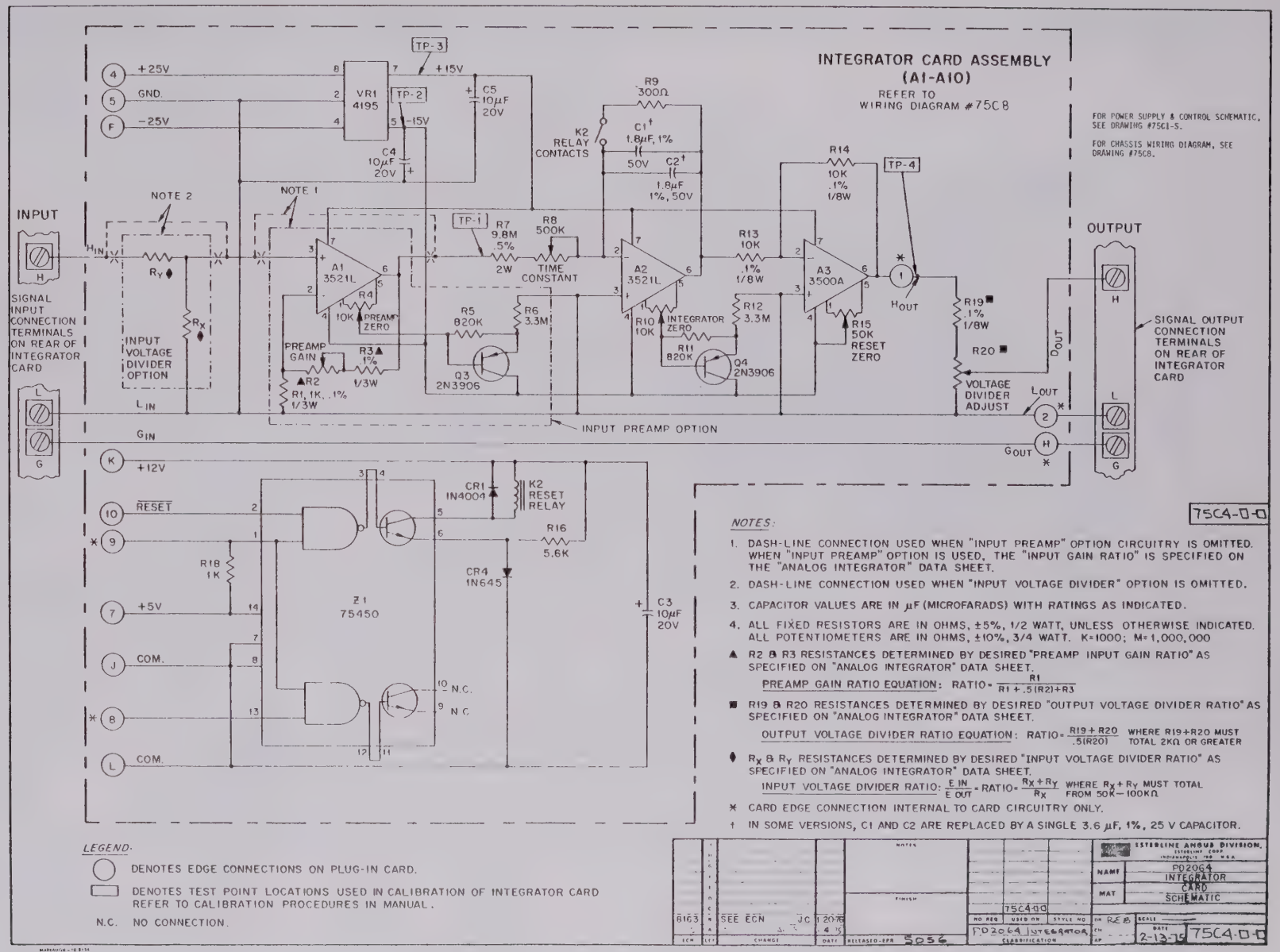
DR P.E.I. SCALE —

CH — AP

DATE 1-20-75

75C8


UNLESS OTHERWISE SPECIFIED
1. TOLERANCE ON FRACTIONAL DIMENSION
LENGTH DIAMETER
2. ECCENTRICITY NOT TO EXCEED 010 TOTAL INDICATOR READING
3. PLATED PARTS MUST FIT GAUGES AFTER BEING PLATED
+5V
33K R4
10uf C7
K5 1K
RG 100Ω
74122 Z2
CB .1uf
C9 .1uf
PART OF J13 ON MASTER UNIT
RESET S2
IN
POWER S1
ON
A
P12 CARD EDGE CONNECTIONS
J12
RESET
GY
R1 1K
R3 1K
R2 1K
Z1
1438 Z1 POWER
+5V SOURCE
+12V SOURCE
7805 +5V REG VR1
7812 +12V REG. VR2
C2 1100uf
C4 33uf
C3 .1uf
C1 1100uf
C5 .33uf
C6 .1uf
CR4 1N4004
CR3 1N4004
CR2 1N4004
CR1 1N4004
J14
T1
F1
TB1
POWER TERMINAL BLOCK
POWER LINE CORD
C1 400V .1
C2 400V .1
BK
GN
WE
BE
OE
RD
RD/YW
BE/YW
BK/OE
BK/RD
WE/OE
BK/WE
P14 CARD EDGE CONNECTIONS
POWER SUPPLY & LOGIC CONTROL
PC CARD ASSY. (MASTER UNIT)
#75C1-4
J13
MASTER UNIT REAR PANEL CONNECTOR (MATES WITH EXTERNAL INTERCONNECTING CABLE)
75C1-S
NOTE 1 - POWER HOOK UP TB1
100VAC JUMPER 2 TO 5
JUMPER 3 TO 6
WE LINES TO 6
C2 TO 6
120VAC JUMPER 2 TO 5
JUMPER 4 TO 7
WE LINES TO 7
C2 TO 7
200VAC JUMPER 3 TO 5
WE LINES TO 6
C2 TO 6
220VAC JUMPER 4 TO 5
WE LINES TO 6
C2 TO 6
240VAC JUMPER 4 TO 5
WE LINES TO 7
C2 TO 7
TO HYDALOG POWER SUPPLIES PC BOARD A11
TO INTEGRATOR PC BOARD CONNECTORS J1 THRU J10
KPC 21 TERMINALS
CHASSIS GROUND
LOGIC GROUND
+5V
LOGIC POWER +5V DC
FOR CHASSIS WIRING DIAGRAM, SEE DRAWING #75C8.
FOR INTEGRATOR CARD SCHEMATIC, SEE DRAWING #75C4-01-01
SLAVE UNIT WIRING (CHAN. 11 THRU 20)
POWER TERMINAL BLOCK
SLAVE UNIT REAR PANEL CONNECTOR (MATES WITH EXTERNAL INTERCONNECTING CABLE)
ESTERLINE ANGUS DIVISION
INDIANAPOLIS IND. U.S.A.
NAME MD 2064 INTEGRATOR
POWER & CONTROL SCHEMATIC
MAT
NOTES
FINISH
75D1-2 SLAVE
75D1-1 MASTER
NO REQ USED ON STYLE NO
PD2064 INTEGRATOR
CLASSIFICATION
DR
SCALE
DATE 1-21-15
75C1-S
RELEASED FOR 5056



75C4-0-0

NOTES:

1. DASH-LINE CONNECTION USED WHEN "INPUT PREAMP" OPTION CIRCUITRY IS OMITTED. WHEN "INPUT PREAMP" OPTION IS USED, THE "INPUT GAIN RATIO" IS SPECIFIED ON THE "ANALOG INTEGRATOR" DATA SHEET.
2. DASH-LINE CONNECTION USED WHEN "INPUT VOLTAGE DIVIDER" OPTION IS OMITTED.
3. CAPACITOR VALUES ARE IN μF (MICROFARADS) WITH RATINGS AS INDICATED.
4. ALL FIXED RESISTORS ARE IN OHMS, ±5%, 1/2 WATT, UNLESS OTHERWISE INDICATED. ALL POTENTIOMETERS ARE IN OHMS, ±10%, 3/4 WATT. K=1000; M=1,000,000

▲ R2 & R3 RESISTANCES DETERMINED BY DESIRED "PREAMP INPUT GAIN RATIO" AS SPECIFIED ON "ANALOG INTEGRATOR" DATA SHEET.

PREAMP GAIN RATIO EQUATION: $\text{RATIO} = \frac{R1}{R1 + .5(R2) + R3}$

■ R19 & R20 RESISTANCES DETERMINED BY DESIRED "OUTPUT VOLTAGE DIVIDER RATIO" AS SPECIFIED ON "ANALOG INTEGRATOR" DATA SHEET.

OUTPUT VOLTAGE DIVIDER RATIO EQUATION: $\text{RATIO} = \frac{R19 + R20}{.5(R20)}$ WHERE R19+R20 MUST TOTAL 2KΩ OR GREATER

♦ R_X & R_Y RESISTANCES DETERMINED BY DESIRED "INPUT VOLTAGE DIVIDER RATIO" AS SPECIFIED ON "ANALOG INTEGRATOR" DATA SHEET.

INPUT VOLTAGE DIVIDER RATIO: $\frac{E\,IN}{E\,OUT} = \text{RATIO} = \frac{R_X + R_Y}{R_X}$ WHERE $R_X + R_Y$ MUST TOTAL FROM 50K — 100KΩ

* CARD EDGE CONNECTION INTERNAL TO CARD CIRCUITRY ONLY.

† IN SOME VERSIONS, C1 AND C2 ARE REPLACED BY A SINGLE 3.6 μF, 1%, 25 V CAPACITOR.

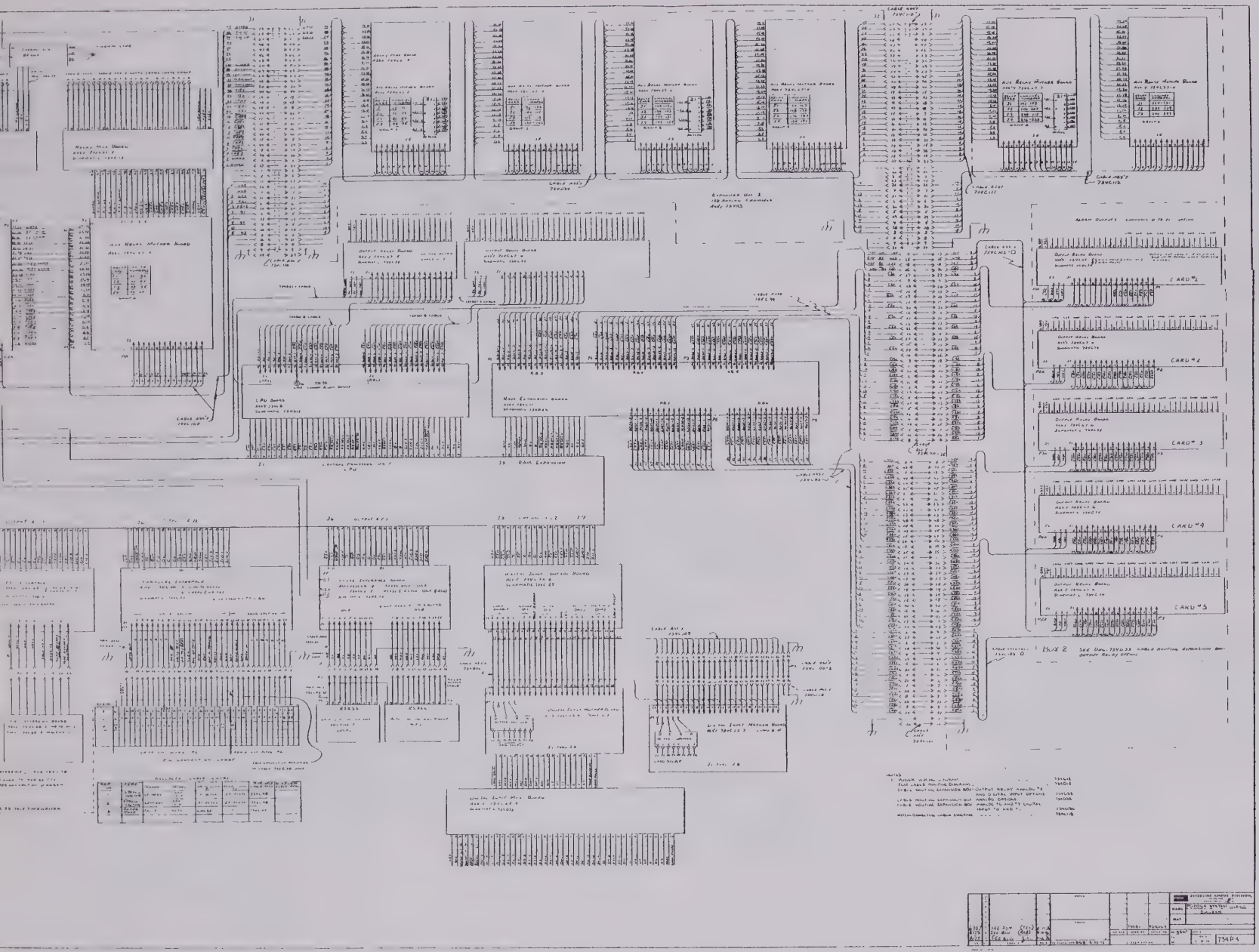
LEGEND:

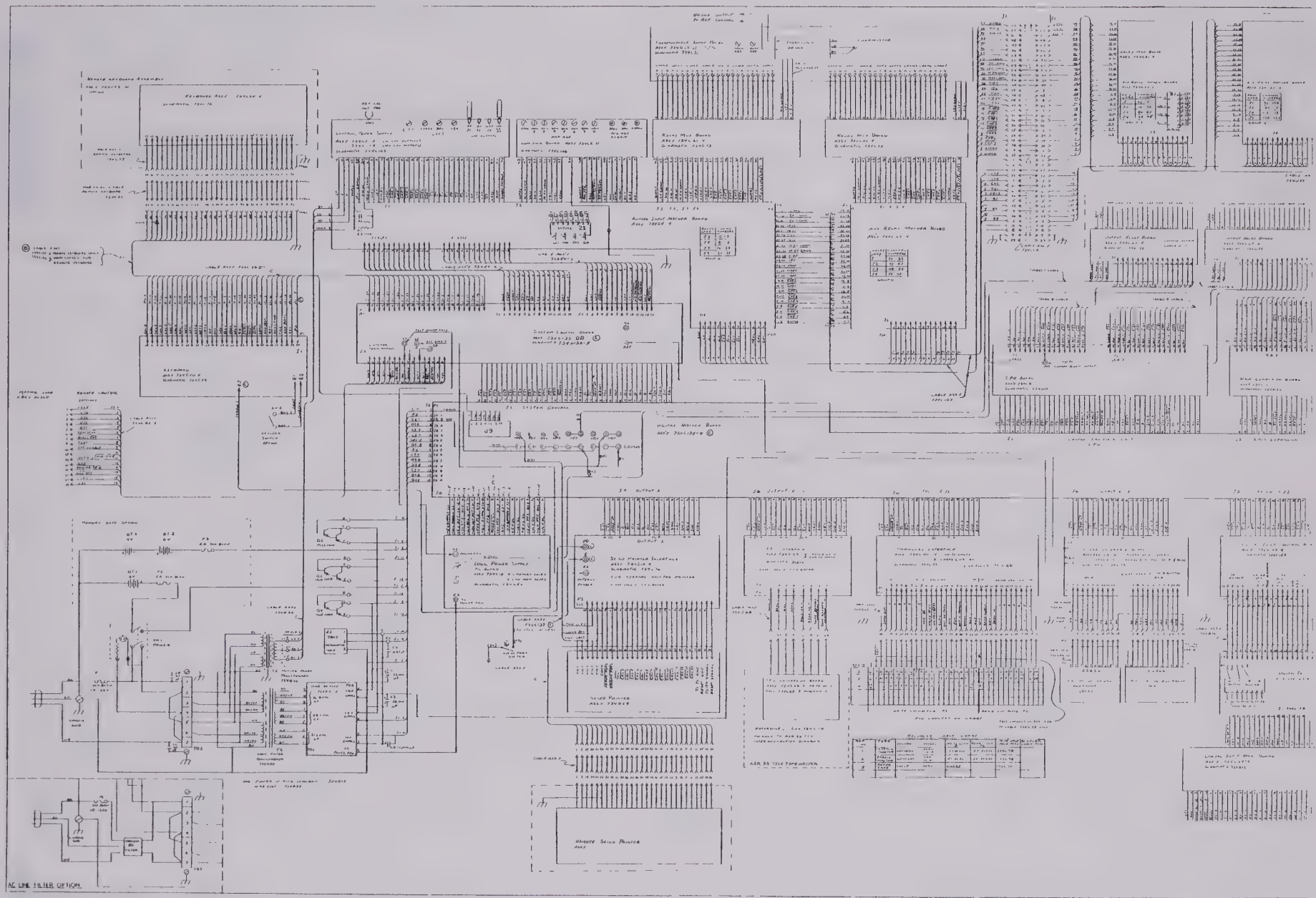
○ DENOTES EDGE CONNECTIONS ON PLUG-IN CARD.

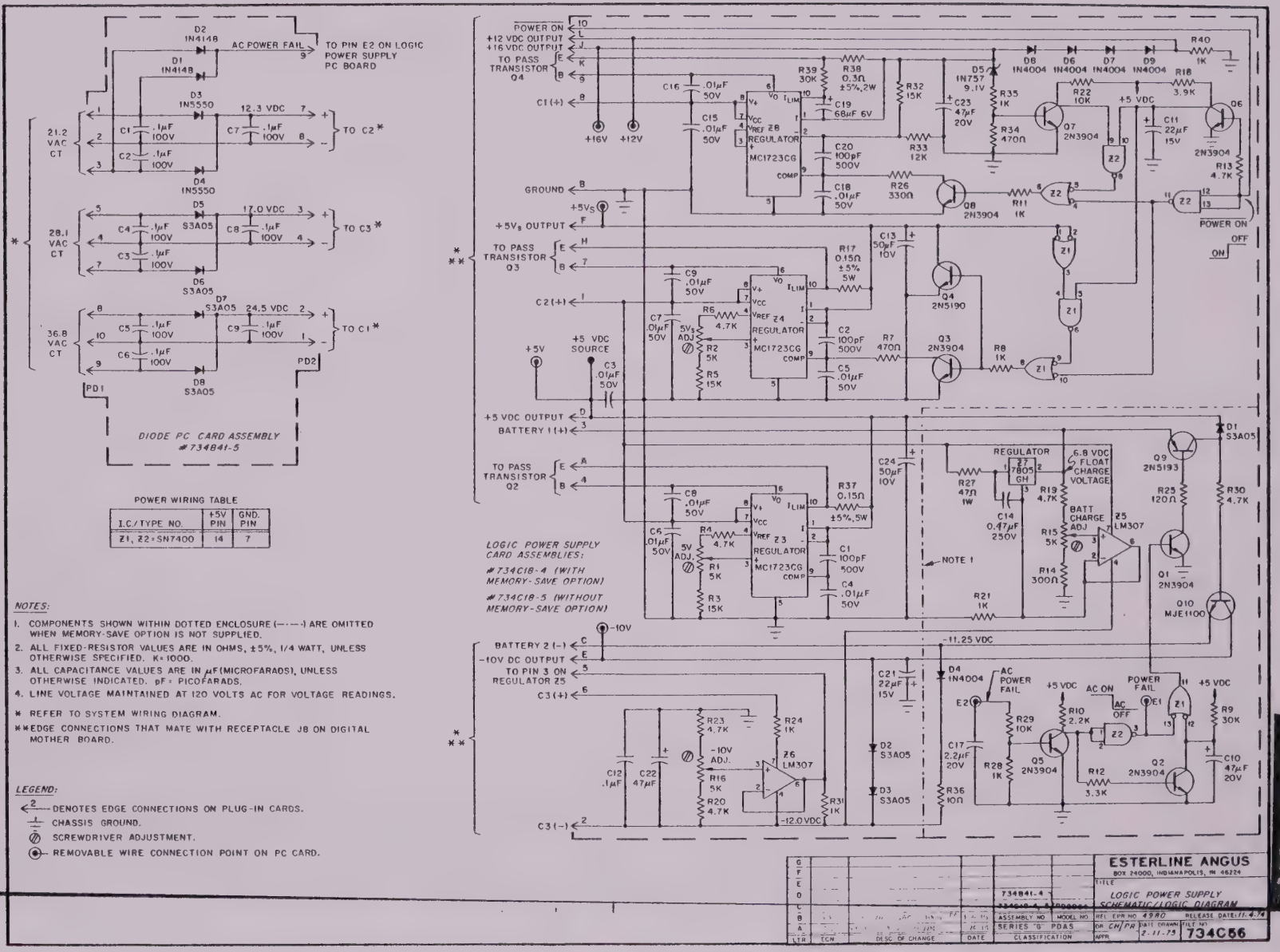
▭ DENOTES TEST POINT LOCATIONS USED IN CALIBRATION OF INTEGRATOR CARD REFER TO CALIBRATION PROCEDURES IN MANUAL.

N.C. NO CONNECTION.

8163	A	SEE ECN	JC	12-75		75C400		ESTERLINE ANGUS DIVISION
ECN	LTR	CHANGE		DATE	NOTES / FINISH	NO REQ / USED ON / STYLE NO	DR R.E.B	NAME: PD2064 INTEGRATOR CARD
				RELEASED-EPR 5056		PD2064 INTEGRATOR CLASSIFICATION	CH / AP	MAT: SCHEMATIC
							DATE 2-13-75	SCALE — 75C4-0-0




AC LINE FILTER OPTION



POWER WIRING TABLE

I.C./TYPE NO.	+5V PIN	GND. PIN
Z1, Z2=SN7400	14	7

NOTES:

1. COMPONENTS SHOWN WITHIN DOTTED ENCLOSURE (— · — ·) ARE OMITTED WHEN MEMORY-SAVE OPTION IS NOT SUPPLIED.
2. ALL FIXED-RESISTOR VALUES ARE IN OHMS, ±5%, 1/4 WATT, UNLESS OTHERWISE SPECIFIED. K=1000.
3. ALL CAPACITANCE VALUES ARE IN μF(MICROFARADS), UNLESS OTHERWISE INDICATED. pF= PICOFARADS.
4. LINE VOLTAGE MAINTAINED AT 120 VOLTS AC FOR VOLTAGE READINGS.

* REFER TO SYSTEM WIRING DIAGRAM.

** EDGE CONNECTIONS THAT MATE WITH RECEPTACLE J8 ON DIGITAL MOTHER BOARD.

LEGEND:

- ←2— DENOTES EDGE CONNECTIONS ON PLUG-IN CARDS.
- ⏚ CHASSIS GROUND.
- ⊘ SCREWDRIVER ADJUSTMENT.
- ⊙ REMOVABLE WIRE CONNECTION POINT ON PC CARD.

GFEDCBA LTR	ECN	DESC OF CHANGE	DATE
		734841-4	
		734818-4, 734818-5	
		ASSEMBLY NO. MODEL NO. SERIES "G" PDAS	CLASSIFICATION

ESTERLINE ANGUS
BOX 24000, INDIANAPOLIS, IN 46224

TITLE
LOGIC POWER SUPPLY SCHEMATIC/LOGIC DIAGRAM

REL EPR NO 4980 RELEASE DATE: 11-4-74
DR CH/PR 2-11-75 FILE NO 734C56
APPR

SECTION G — SUPPLEMENTAL INSTRUCTIONS

G.1 PD-2064 MEMORY STORAGE LOCATIONS

G.1.1 GENERAL

Memories which provide operational instructions for the 4-bit microprocessor are stored in as many as 16 read only memories (ROMs) and 32 random access memories (RAMs). Refer to paragraph 1.2.1 in Section 1 of manual for description of central processing unit (CPU).

G.1.2 ROM ALLOCATIONS

a. The microprocessor (Z22) and all 16 ROMs plug into designated sockets on the CPU card as shown in Figure G-1. The standard PD-2064 system consists of 6 basic ROMs with provision for an additional 10 ROM options.

b. Refer to Table 1-1 in Section 1 of manual for specific ROM allocations and corresponding program functions.

G.1.3 RAM ALLOCATIONS

a. The basic system provides up to 12 RAM storage locations on the CPU card as shown in Figure G-1. RAM Z23 is used to store the system constants; whereas, the 11 remaining RAMs (Z24 - Z34) share in the storage of channel input data and channel alarm setpoints (if "Alarm" option is included in system).

b. Memory storage expansion beyond the 11 basic RAMs on the CPU card is provided by an optional RAM expansion card. This card provides up to 20 additional RAM storage locations (Z1 - Z20) as shown in Figure G-1. The RAMs on the expansion card are similarly used to share the storage of channel input data and channel alarm setpoints (if "Alarm" option is included in system).

c. The RAM storage allocations for single channel programming systems and channel pair programming systems are given in Tables G-1 and G-2, respectively. Memory storage equivalents per RAM are given by the following equations:

(1) 1 RAM = data storage for 4 analog or 4 digital channels in single channel programming systems.

(2) 1 RAM = data storage for 8 analog or 8 digital channels in channel pair programming systems.

(3) 1 RAM = alarm setpoint storage for 8 channels having one setpoint (high or low) per channel.

(4) 1 RAM = alarm setpoint storage for 4 channels having two setpoints (high and low) per channel.

d. To determine the existing RAM storage allocations in a particular data system, refer to the instrument Data Sheet and obtain following specifications:

(1) Under Entry No. 4 (PROGRAMMING OPTIONS), find:

(a) Type of programming system -- either single channel or channel pair programming system.

(b) Number of channels with alarm setpoints and whether setpoints are single or dual per channel.

(2) Under Entry No. 5 (SIGNAL INPUT OPTIONS), find number of analog and digital channels.

e. After appropriate specifications have been gathered from Data Sheet, RAM allocations may be determined as typified by the examples illustrated in Figures G-2 and G-3.

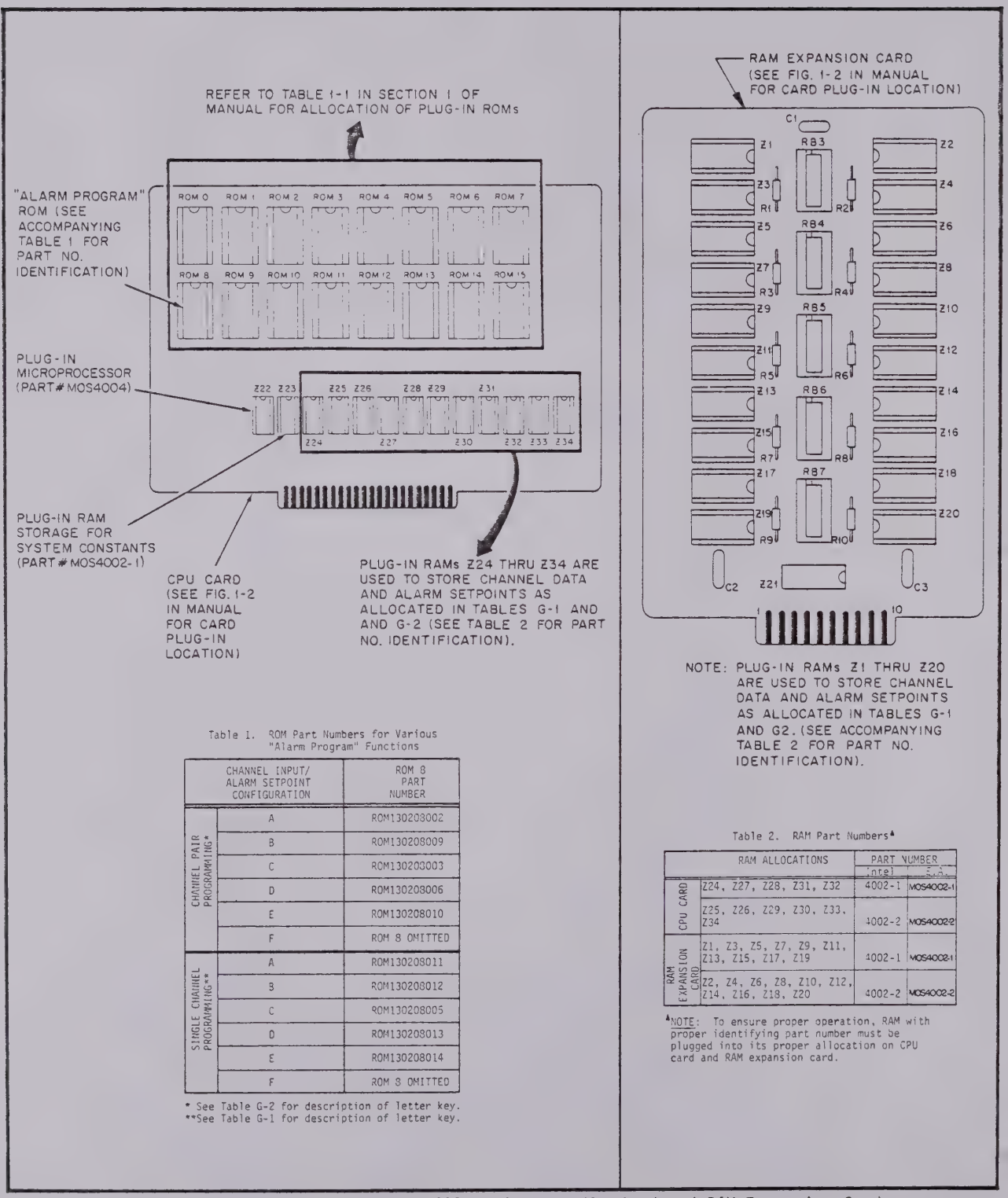

REFER TO TABLE 1-1 IN SECTION 1 OF MANUAL FOR ALLOCATION OF PLUG-IN ROMs
"ALARM PROGRAM" ROM (SEE ACCOMPANYING TABLE 1 FOR PART NO. IDENTIFICATION)
ROM 0 ROM 1 ROM 2 ROM 3 ROM 4 ROM 5 ROM 6 ROM 7
ROM 8 ROM 9 ROM 10 ROM 11 ROM 12 ROM 13 ROM 14 ROM 15
PLUG-IN MICROPROCESSOR (PART# MOS4004)
Z22 Z23 Z25 Z26 Z28 Z29 Z31
Z24 Z27 Z30 Z32 Z33 Z34
PLUG-IN RAM STORAGE FOR SYSTEM CONSTANTS (PART# MOS4002-1)
CPU CARD (SEE FIG. 1-2 IN MANUAL FOR CARD PLUG-IN LOCATION)
PLUG-IN RAMs Z24 THRU Z34 ARE USED TO STORE CHANNEL DATA AND ALARM SETPOINTS AS ALLOCATED IN TABLES G-1 AND AND G-2 (SEE TABLE 2 FOR PART NO. IDENTIFICATION).
RAM EXPANSION CARD (SEE FIG. 1-2 IN MANUAL FOR CARD PLUG-IN LOCATION)
C1
Z1 Z2 Z3 Z4 Z5 Z6 Z7 Z8 Z9 Z10 Z11 Z12 Z13 Z14 Z15 Z16 Z17 Z18 Z19 Z20
R83 R84 R85 R86 R87
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10
C2 Z21 C3
1 10
NOTE: PLUG-IN RAMs Z1 THRU Z20 ARE USED TO STORE CHANNEL DATA AND ALARM SETPOINTS AS ALLOCATED IN TABLES G-1 AND G2. (SEE ACCOMPANYING TABLE 2 FOR PART NO. IDENTIFICATION).

Table 1. ROM Part Numbers for Various "Alarm Program" Functions

	CHANNEL INPUT/ ALARM SETPOINT CONFIGURATION	ROM 8 PART NUMBER
CHANNEL PAIR PROGRAMMING*	A	ROM130208002
	B	ROM130208009
	C	ROM130208003
	D	ROM130208006
	E	ROM130208010
	F	ROM 8 OMITTED
SINGLE CHANNEL PROGRAMMING**	A	ROM130208011
	B	ROM130208012
	C	ROM130208005
	D	ROM130208013
	E	ROM130208014
	F	ROM 8 OMITTED

* See Table G-2 for description of letter key.
**See Table G-1 for description of letter key.

Table 2. RAM Part Numbers[A]

	RAM ALLOCATIONS	PART NUMBER Intel	PART NUMBER S.A.
CPU CARD	Z24, Z27, Z28, Z31, Z32	4002-1	MOS4002-1
	Z25, Z26, Z29, Z30, Z33, Z34	4002-2	MOS4002-2
RAM EXPANSION CARD	Z1, Z3, Z5, Z7, Z9, Z11, Z13, Z15, Z17, Z19	4002-1	MOS4002-1
	Z2, Z4, Z6, Z8, Z10, Z12, Z14, Z16, Z18, Z20	4002-2	MOS4002-2

[A]NOTE: To ensure proper operation, RAM with proper identifying part number must be plugged into its proper allocation on CPU card and RAM expansion card.

Figure G-1. RAM and ROM Storage Allocations on CPU Card and RAM Expansion Card.

Table G-1. RAM Allocations for Single Channel Programming Systems.

CHANNEL INPUT/ALARM SETPOINT SYSTEM CONFIGURATION													RAM ALLOCATION	
A		B		C		D		E		F				
UP TO 24 CHANNEL INPUTS WITH TWO SETPOINTS (HIGH AND LOW) FOR UP TO 16 CHANNELS		UP TO 24 CHANNEL INPUTS WITH ONE SETPOINT (HIGH OR LOW) PER CHANNEL		UP TO 64 CHANNEL INPUTS WITH TWO SETPOINTS (HIGH AND LOW) FOR UP TO 56 CHANNELS		UP TO 80 CHANNEL INPUTS WITH ONE SETPOINT (HIGH OR LOW) PER CHANNEL		UP TO 116 CHANNEL INPUTS WITH ONE COMMON ALARM (HIGH AND LOW) FOR ENTIRE CHANNEL SYSTEM		UP TO 124 CHANNEL INPUTS WITH NO ALARMS			
Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory		
Ch. 0-3		Ch. 0-3		Ch. 0-3		Ch. 0-3		Ch. 0-3		Ch. 0-3		Z24	LOCATED ON CPU CARD (SEE FIG. G-1)
4-7		4-7		8-11		4-7		4-7		4-7		Z25	
8-11		8-11		12-15		8-11		8-11		8-11		Z26	
12-15		12-15		16-19		12-15		12-15		12-15		Z27	
16-19		16-19		20-23		16-19		16-19		16-19		Z28	
20-23		20-23		24-27		20-23		20-23		20-23		Z29	
				28-31		24-27		24-27		24-27		Z30	
	Ch. 0-3			32-35		28-31		28-31		28-31		Z31	
	4-7		Ch. 0-7	36-39		32-35		32-35		32-35		Z32	
	8-11		8-15	40-43		36-39		36-39		36-39		Z33	
	12-15		16-23			40-43		40-43		40-43		Z34	
				44-47		44-47		44-47		44-47		Z1	LOCATED ON RAM EXPANSION CARD (SEE FIG. G-1)
				48-51		48-51		48-51		48-51		Z3	
				52-55		52-55		52-55		52-55		Z4	
				56-59		56-59		56-59		56-59		Z2	
				60-63		60-63		60-63		60-63		Z5	
						64-67		64-67		64-67		Z7	
					Ch. 0-3	68-71		68-71		68-71		Z8	
					4-7	72-75		72-75		72-75		Z6	
					8-11	76-79		76-79		76-79		Z9	
					12-15			80-83		80-83		Z11	
					16-19		Ch. 0-7	84-87		84-87		Z12	
					20-23		8-15	88-91		88-91		Z10	
					24-27		16-23	92-95		92-95		Z13	
					28-31		24-31	96-99		96-99		Z15	
					32-35		32-39	100-103		100-103		Z16	
					36-39		40-47	104-107		104-107		Z14	
					40-43		48-55	108-111		108-111		Z17	
					44-47		56-63	112-115		112-115		Z19	
					48-51		64-71			116-119		Z20	
					52-55		72-79		COMMON ALARM	120-123		Z18	

Table G-2. RAM Allocations for Channel Pair Programming Systems.

CHANNEL INPUT/ALARM SETPOINT SYSTEM CONFIGURATION												RAM ALLOCATIONS	
A		B		C		D		E		F			
UP TO 32 CHANNEL INPUTS WITH TWO SETPOINTS (HIGH AND LOW) FOR UP TO 24 CHANNELS		UP TO 40 CHANNEL INPUTS WITH ONE SETPOINT (HIGH OR LOW) PER CHANNEL		UP TO 96 CHANNEL INPUTS WITH TWO SETPOINTS (HIGH AND LOW) FOR UP TO 64 CHANNELS		UP TO 120 CHANNEL INPUTS WITH ONE SETPOINT (HIGH OR LOW) PER CHANNEL		UP TO 232 CHANNEL INPUTS WITH ONE COMMON ALARM (HIGH AND LOW) FOR ENTIRE CHANNEL SYSTEM		UP TO 248 CHANNEL INPUTS WITH NO ALARMS			
Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory	Channel Data Memory	Alarm Setpoint Memory		
Ch. 0-7		Ch. 0-7		Ch. 0-7		Ch. 0-7		Ch. 0-7		Ch. 0-7		Z24	LOCATED ON CPU CARD (SEE FIG. G-1)
8-15		8-15		8-15		8-15		8-15		8-15		Z25	
16-23		16-23		16-23		16-23		16-23		16-23		Z26	
24-31		24-31		24-31		24-31		24-31		24-31		Z27	
		32-39		32-39		32-39		32-39		32-39		Z28	
	Ch. 0-3			40-47		40-47		40-47		40-47		Z29	
	4-7		Ch. 0-7	48-55		48-55		48-55		48-55		Z30	
	8-11		8-15	56-63		56-63		56-63		56-63		Z31	
	12-15		16-23	64-71		64-71		64-71		64-71		Z32	
	16-19		24-31	72-79		72-79		72-79		72-79		Z33	
	20-23		32-39	80-87		80-87		80-87		80-87		Z34	
				88-95		88-95		88-95		88-95		Z1	LOCATED ON RAM EXPANSION CARD (SEE FIG. G-1)
						96-103		96-103		96-103		Z3	
					Ch. 0-3	104-111		104-111		104-111		Z4	
					4-7	112-119		112-119		112-119		Z2	
					8-11			120-127		120-127		Z5	
					12-15		Ch. 0-7	128-135		128-135		Z7	
					16-19		8-15	136-143		136-143		Z8	
					20-23		16-23	144-151		144-151		Z6	
					24-27		24-31	152-159		152-159		Z9	
					28-31		32-39	160-167		160-167		Z11	
					32-35		40-47	168-175		168-175		Z12	
					36-39		48-55	176-183		176-183		Z10	
					40-43		56-63	184-191		184-191		Z13	
					44-47		64-71	192-199		192-199		Z15	
					48-51		72-79	200-207		200-207		Z16	
					52-55		80-87	208-215		208-215		Z14	
					56-59		88-95	216-223		216-223		Z17	
					60-63		96-103	224-231		224-231		Z19	
							104-111			232-239		Z20	
							112-119		COMMON ALARM	240-247		Z18	

A. Type of Channel Input/Alarm Setpoint Configuration as Derived From Instrument Data Sheet:

(1) Single channel programming system.

(2) 64 analog channel inputs with dual setpoints on 56 channels.

B. Determining RAM Allocations:

(1) From Equation #1, it is calculated that 16 RAMs are required to store the data of 64 channels.

(2) From Equation #4, it is calculated that 14 RAMs are required to store the alarm setpoints of 56 channels.

(3) Referring to Table G-1, Configuration "C" fits the parameters of the configuration specified in this example.

(4) Reading down Configuration "C" column, RAM allocations are determined as follows:

(a) For channel numbers given in "Channel Data Memory" and "Alarm Setpoint Memory" columns, refer to "RAM Allocation" column at extreme, right-hand side of table to find corresponding RAM numbers (Z numbers) in which memory is being stored.

(b) For instance, the channel data for channels 0-3, 20-23, and 40-43 is stored in RAMs Z24, Z29, and Z34 on the CPU card, respectively; and, in like manner, channel data for channels 44-47, 52-55, and 60-63 is stored in RAMs Z1, Z4, and Z5 on the RAM expansion card, respectively.

(c) For a similar instance, the alarm setpoints for channels 0-3, 16-19, 32-35, and 52-55 are stored in RAMs Z8, Z12, Z16, and Z18 on the RAM expansion card, respectively.

(d) The location of each RAM on the CPU card and RAM expansion card are identified in Figure G-1. Corresponding part numbers for each RAM are also listed in Table 2 of Figure G-1.

C. ROM 8 PROGRAM ALLOCATION:

(1) In addition to the proper RAM allocations in a particular system, the proper "Alarm Program" ROM (if "Alarms" are used) must be plugged into the ROM 8 position on the CPU card as shown in Figure G-1.

(2) The part number of this ROM is found from Table 1 in Figure G-1. For Configuration "C" cited in this example, the corresponding part number for ROM 8 is found to be ROM130208005.

Figure G-2. Example for Determining Memory Storage Locations in Single Channel Programming Systems.

A. Type of Channel Input/Alarm Setpoint Configuration as Derived From Instrument Data Sheet:

(1) Channel pair programming system.

(2) 32 analog channel inputs and 4 digital channel inputs for total of 36 channel inputs.

(3) Single setpoint per channel for all 36 channels.

B. Determining RAM Allocations:

(1) From Equation #2, it is calculated that 5 RAMs are required to store the data of 36 channels.

NOTE: Total storage capacity of 5th RAM will not be used. Unused storage will provide for 4 additional channels.

(2) From Equation #3, it is calculated that 5 RAMs are required to store the alarm setpoints of 36 channels.

NOTE: Total storage capacity of 5th RAM will not be used. Unused storage will provide setpoints for 4 additional channels.

(3) Referring to Table G-2, Configuration "B" fits the parameters of the configuration specified in this example.

(4) Reading down Configuration "B" column, RAM allocations are determined as follows:

(a) For channel numbers given in "Channel Data Memory" and "Alarm Setpoint Memory" columns, refer to "RAM Allocation" column at extreme, right-hand side of table to find corresponding RAM numbers (Z numbers) in which memory is being stored.

(b) For instance, the channel data for channels 0-7 is stored in RAM Z24 on the CPU card, and so forth. Similarly, the alarm setpoints for channels 0-7 are stored in RAM Z30 on the CPU card, the alarm setpoints for channels 8-15 are stored in RAM Z31 on the CPU card, and so forth.

(c) The location of each RAM on the CPU card and RAM expansion card are identified in Figure G-1. Corresponding part numbers for each RAM are also listed in Table 2 of Figure G-1.

C. ROM 8 PROGRAM ALLOCATION

(1) In addition to the proper RAM allocations in a particular system, the proper "Alarm Program" ROM (if "Alarms" are used) must be plugged into the ROM 8 position on the CPU card as shown in Figure G-1.

(2) The part number of this ROM is found from Table 1 in Figure G-1. For Configuration "B" cited in this example, the corresponding part number for ROM 8 is found to be ROM130208009.

Figure G-3. Example for Determining Memory Storage Locations in Channel Pair Programming Systems.

G.2 KEYBOARD PROGRAMMING OF HIGH-LOW, COMMON-ALARM SETPOINTS

a. The high-low, common-alarm setpoint option provides only one high and one low setpoint that may be applied to any channel or channel pair in the data system. Channels that are required to have the alarm-detection function (as determined by the high-low, common-alarm setpoint settings) are then programmed with a special 2-character "Alarms" correction function code as listed on the Data Sheet.

b. The memory storage for the high-low, common-alarm setpoints is located in RAM Z18 on the RAM expansion card.

c. The procedures for keyboard programming of the common-alarm setpoint system is essentially the same as procedures used to program setpoints on an individual channel basis. Proceed as follows:

(1) With instrument power turned on, press INPUT key to select "Input" mode of system operation (display should read all L's).

(2) Select any channel in system by following procedures given under keyboard programming Section 3.1 on left-hand, fold-out sheet of operational flow diagram (located at end of "Section 3").

(3) After channel has been selected, enter the desired high and low setpoints by following procedures under keyboard programming Section 3.5 on flow diagram. After high- and low-alarm setpoints have been entered into memory, select other channels in system and note that entered setpoints now commonly apply to all channels in system.

(4) After high- and low-alarm setpoints have been entered, select channels for which it is desired to perform the alarm-function correction. For each channel or channel pair selected (per keyboard programming Section 3.1 on flow diagram), enter the appropriate 2-character "Alarms" correction function code by following procedures under keyboard programming Section 3.4 on flow diagram. If it is appropriate to group (block) the 2-character correction function code for channels, refer to paragraph 3.5.6.3 or 3.5.6.4 in "Section 3" of manual.

> NOTE: If reference channel(s) are used in measurement applications, do NOT enter the "Alarms" correction function code for the reference channel(s).

(5) The common-alarm system is now programmed. If "Auto" mode of operating system is desired, press AUTO key.

d. For further description of the "Alarm" option features, refer to paragraph 3.5.3 and its subparagraphs in "Section 3" of manual.

> NOTE: For description of common-alarm relay output functions, refer to instruction form #PD-2064ARO in "Section B" of manual.

G.3 "ASSIGNABLE DUAL-SETPOINT ALARMS" OPTION

SCOPE: This supplemental instruction (Form #PD-2064AAS) covers the description and operation of the assignable dual-setpoint alarm option which is termed the "Class B" type of alarm setpoint configuration. Refer to Table 3-1 in "Section 3" of manual for a breakdown of the "Class A" and "Class B" alarm system configurations. For description and programming of the "Class A" alarm system, refer to paragraph 3.5.3 and its sub-paragraphs in "Section 3" of manual.

G.3.1 GENERAL

a. The "Class B" type of alarm setpoints (assignable dual setpoints) differs from the "Class A" type of alarm setpoints in that any dual setpoint may be assigned to any or all channels in the system. In the "Class A" type of alarm setpoints, either dual or single setpoints are only assignable to certain fixed channels in the system.

b. The alarm setpoints are available in increments of 4, 8, 12, and 16 dual setpoints. The dual setpoints are assignable to: (1) a maximum of 208 channels in channel pair programming systems or (2) a maximum of 104 channels in single channel programming systems. See channel data RAM allocations in Table G-3.

c. Each increment of 4 dual setpoints is stored in a RAM located on the RAM expansion card. The RAMs are allocated per listing in Table G-3. Each dual setpoint may be programmed to operate in one of the three following modes: (1) conventional high-low mode, or (2) alternate higher-high mode, or (3) alternate lower-low mode. Refer to paragraph G.3.6 for procedures in programming the assignable setpoints and the alarm setpoint modes of operation.

G.3.2 ROM and RAM REQUIREMENTS

a. The plug-in ROM requirements for the assignable setpoint option consist of ROMs 3, 7, 8, and 10 as identified on the CPU card in Figure G-4. If the optional 8-digit data output program instead of the standard 7-digit data output program is used for the "Seiko" printer (output device #1), optional ROM 5 identified by Part #ROM130205003 is substituted for the basic ROM 5 having Part #ROM130205001.

> NOTE: Incorporation of the assignable setpoint option precludes the use of other standard options which require the program functions of ROMs 3, 7, 8, and 10.

b. The RAM requirements for a particular assignable alarm system may be determined by referring to Table G-3. The RAM plug-in locations and part numbers are identified in Figure G-4.

G.3.3 OPERATIONAL ASPECTS

G.3.3.1 SETPOINT ASSIGNMENT

a. Depending upon the alarm setpoint storage capacity (1 RAM=4 dual setpoints) provided on the RAM expansion card, the setpoints can be supplied in increments of 4, 8, 12, and 16 dual setpoints. See Table G-3 for the alarm setpoint storage RAM allocations.

b. Dual setpoint numbers (0-15) that have been assigned to particular channels (via the system programming) are identified by a corresponding setpoint number code in the most significant digit (MSD) of the display whenever the assigned channel's data memory storage is viewed. If the optional 8-digit data output program that controls the "Seiko" printer is used in the system, the assigned channel's setpoint number code is printed in the 8th digit position of the channel's data line.

c. The setpoint number codes corresponding to the dual setpoint numbers are listed in Table G-4. See typical display and printout examples shown in the "Alarm Indication" column of Table G-7.

d. The alarm setpoint number assignment may automatically be programmed into the system via the "Custom Initialization" option (see paragraph 3.5.1 in "Section 3" of manual); or it may be programmed into the system from the keyboard in two different ways. The normal programming entry from the keyboard is described in the programming procedures under paragraph G.3.6.

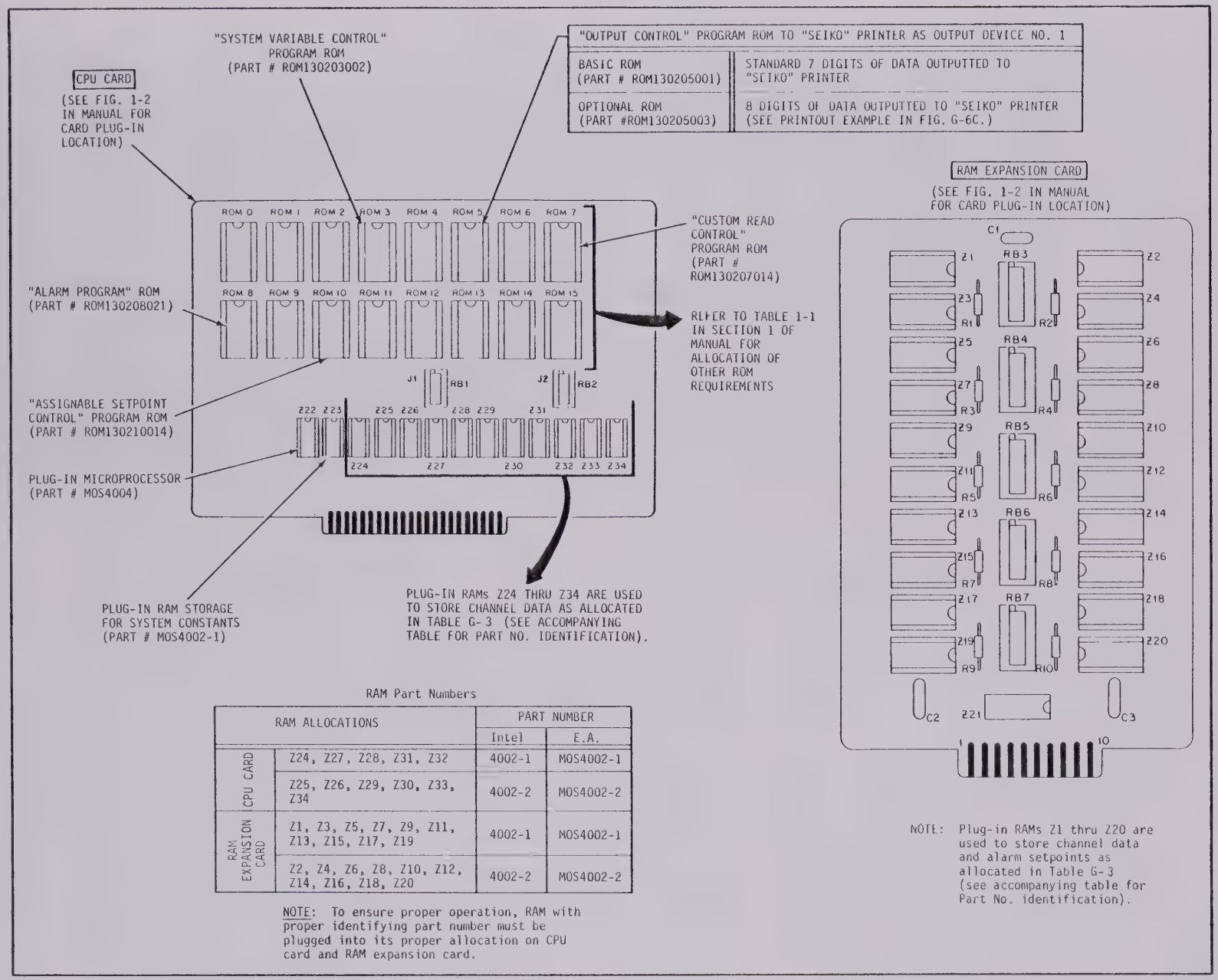
e. Another method for entering the alarm setpoint number from the keyboard is through the functions of the CHAN READ key and an external entry from the most significant digit input (digit 7) on the optional remote control connector. If a particular channel's data is being monitored via depressing of the CHAN READ key, the MSD read in through the remote control connector is shown in the MSD of the display. Pressing the ENTER key registers this MSD in memory and thus becomes the new setpoint number code assignment for the monitored channel and any other channels that had the same setpoint assignment as the monitored channel.

Table G-3. RAM Allocations for Assignable Setpoint Alarm Systems.

CHANNEL PROGRAMMING SYSTEM		ALARM	RAM	RAM BANK OUTPUT PORTS		PC CARD
Single Channel Data Memory	Channel Pair Data Memory	DUAL-SETPOINTS MEMORY[1]	ALLOCATIONS	Alarm Relay Outputs	RAM Bank Location	LOCATION
Ch. 0-3	Ch. 0-7		Z24		RB 0	CPU Card (See Fig. G-4)
4-7	8-15		Z25			
8-11	16-23		Z26			
12-15	24-31		Z27		RB 1 (J1)	
16-19	32-39		Z28[2]	1 Common High, 1 Common Low, 1 Common High or Low (For Dual Setpoint Numbers 0-15)		
20-23	40-47		Z29[2]	2 High, 2 Low (For Dual Setpoint Numbers 0,1)		
24-27	48-55		Z30[2]	2 High, 2 Low (For Dual Setpoint Numbers 2,3)		
28-31	56-63		Z31[2]	2 High, 2 Low (For Dual Setpoint Numbers 4,5)	RB 2 (J2)	
32-35	64-71		Z32[2]	2 High, 2 Low (For Dual Setpoint Numbers 6,7)		
36-39	72-79		Z33[2]	2 High, 2 Low (For Dual Setpoint Numbers 8,9)		
40-43	80-87		Z34[2]	2 High, 2 Low (For Dual Setpoint Numbers 10,11)		
44-47	88-95		Z1[2]	2 High, 2 Low (For Dual Setpoint Numbers 12,13)	RB 3	RAM Expansion Card (See Fig. G-4)
48-51	96-103		Z3[2]	2 High, 2 Low (For Dual Setpoint Numbers 14,15)		
52-55	104-111		Z4			
56-59	112-119		Z2			
60-63	120-127		Z5		RB 4	
64-67	128-135		Z7			
68-71	136-143		Z8			
72-75	144-151		Z6			
76-79	152-159		Z9		RB 5	
80-83	160-167		Z11			
84-87	168-175		Z12			
88-91	176-183		Z10			
92-95	184-191		Z13		RB 6	
96-99	192-199		Z15			
100-103	200-207		Z16			
104-107	208-215		Z14			
108-111	216-223	4 Dual Setpoints (Numbers 0-3)	Z17		RB 7	
112-115	224-231	4 Dual Setpoints (Numbers 4-7)	Z19			
116-119	232-239	4 Dual Setpoints (Numbers 8-11)	Z20			
120-123	240-247	4 Dual Setpoints (Numbers 12-15)	Z18			

[1] Type of dual setpoints may be High-Low, or Higher-High, or Lower-Low and are assignable to any of the channel inputs in the system.

[2] If any of the corresponding alarm relay output ports are used, this RAM must be plugged into its designated location.


"SYSTEM VARIABLE CONTROL" PROGRAM ROM (PART # ROM130203002)
CPU CARD
(SEE FIG. 1-2 IN MANUAL FOR CARD PLUG-IN LOCATION)
"OUTPUT CONTROL" PROGRAM ROM TO "SEIKO" PRINTER AS OUTPUT DEVICE NO. 1
BASIC ROM (PART # ROM130205001)
STANDARD 7 DIGITS OF DATA OUTPUTTED TO "SEIKO" PRINTER
OPTIONAL ROM (PART #ROM130205003)
8 DIGITS OF DATA OUTPUTTED TO "SEIKO" PRINTER (SEE PRINTOUT EXAMPLE IN FIG. G-6C.)
ROM 0 ROM 1 ROM 2 ROM 3 ROM 4 ROM 5 ROM 6 ROM 7
ROM 8 ROM 9 ROM 10 ROM 11 ROM 12 ROM 13 ROM 14 ROM 15
"CUSTOM READ CONTROL" PROGRAM ROM (PART # ROM130207014)
"ALARM PROGRAM" ROM (PART # ROM130208021)
REFER TO TABLE 1-1 IN SECTION 1 OF MANUAL FOR ALLOCATION OF OTHER ROM REQUIREMENTS
J1 RB1 J2 RB2
"ASSIGNABLE SETPOINT CONTROL" PROGRAM ROM (PART # ROM130210014)
Z22 Z23 Z25 Z26 Z28 Z29 Z31
Z24 Z27 Z30 Z32 Z33 Z34
PLUG-IN MICROPROCESSOR (PART # MOS4004)
PLUG-IN RAM STORAGE FOR SYSTEM CONSTANTS (PART # MOS4002-1)
PLUG-IN RAMs Z24 THRU Z34 ARE USED TO STORE CHANNEL DATA AS ALLOCATED IN TABLE G-3 (SEE ACCOMPANYING TABLE FOR PART NO. IDENTIFICATION).
RAM EXPANSION CARD
(SEE FIG. 1-2 IN MANUAL FOR CARD PLUG-IN LOCATION)
C1
Z1 Z2 Z3 Z4 Z5 Z6 Z7 Z8 Z9 Z10 Z11 Z12 Z13 Z14 Z15 Z16 Z17 Z18 Z19 Z20
RB3 RB4 RB5 RB6 RB7
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10
C2 Z21 C3
1 10
NOTE: Plug-in RAMs Z1 thru Z20 are used to store channel data and alarm setpoints as allocated in Table G-3 (see accompanying table for Part No. identification).

RAM Part Numbers

RAM ALLOCATIONS		PART NUMBER	
		Intel	E.A.
CPU CARD	Z24, Z27, Z28, Z31, Z32	4002-1	MOS4002-1
CPU CARD	Z25, Z26, Z29, Z30, Z33, Z34	4002-2	MOS4002-2
RAM EXPANSION CARD	Z1, Z3, Z5, Z7, Z9, Z11, Z13, Z15, Z17, Z19	4002-1	MOS4002-1
RAM EXPANSION CARD	Z2, Z4, Z6, Z8, Z10, Z12, Z14, Z16, Z18, Z20	4002-2	MOS4002-2

NOTE: To ensure proper operation, RAM with proper identifying part number must be plugged into its proper allocation on CPU card and RAM expansion card.

P-1504

Figure G-4. ROM and RAM Requirements for Assignable Dual-Setpoint Alarms Option.

Table G-4. Setpoint Number Codes.

ASSIGNABLE DUAL SETPOINT NUMBER	CORRESPONDING SETPOINT NUMBER CODE DISPLAYED (MSD POSITION OF DISPLAY)	CORRESPONDING SETPOINT NUMBER CODE PRINTED ON "SEIKO" PRINTER (8TH DIGIT POSITION)*
00	0	0
01	1	1
02	2	2
03	3	3
04	4	4
05	5	5
06	6	6
07	7	7
08	8	8
09	9	9
10	-	-
11	.	.
12	A	:
13	'	Ch
14	L	*
15	Blank	Blank

* Printout of Setpoint Number Code is Applicable Only When System is Equipped With the "Seiko" 8-Digit Data Output Control Program (ROM130205003).

CAUTION: A setpoint assignment that exists for certain channels in the system may inadvertently be changed through the functions of the CHAN READ key. For example, if a channel is being monitored (without external entry of the MSD via optional remote control connector) and the ENTER key is pressed, a blank code (15) will be entered as the new setpoint assignment, thus overwriting the previously existing one. Also, if per chance keyboard entry data (or substitute data) is entered into the channel data storage when monitoring with the CHAN READ key and the ENTER key is pressed, the setpoint assignment will be changed to the code that has been entered in the MSD.

f. The external entry of the MSD via the remote control connector may also be used to implement a variable setpoint assignment to channels as they are being scanned, thus enabling the user to externally custom select which setpoints the channels would address. This arrangement can be externally implemented through appropriate hardware by using the binary channel address that is outputted to the output ports of RAMs Z2 and Z4 of RAM bank 3 during channel scanning only.

NOTE: Only the codes for setpoint numbers 0 through 14 can be externally entered via the MSD input of the remote control connector.

G.3.3.2 SETPOINT MODE SELECTION

a. The assignment of each channel's dual-setpoint alarm may be programmed to operate in one of the three following modes: high-low, or higher-high, or lower-low. A breakdown of the setpoint modes is given in Table G-5.

Table G-5. Breakdown of Setpoint Modes.

SETPOINT MODE	SETPOINT CODE	ALARM PRIORITY	KEY CONTROL
High-Low	Any Number From 0 Thru 9	High=Higher Priority	HIGH ALARM
		Low=Lower Priority	LOW ALARM
Higher-High	A(12 Code)	Higher=Higher Priority	HIGH ALARM
		High=Lower Priority	LOW ALARM
Lower-Low	-(10 Code)	Lower=Higher Priority	HIGH ALARM
		Low=Lower Priority	LOW ALARM

b. Selection of the setpoint mode is made by programming a setpoint mode code (via the functions of the RANGE key) into the dual-setpoint storage locations which correspond to the equivalent channel address number. The dual-setpoint numbers, their equivalent channel address locations, and the setpoint mode selection codes are depicted in Table G-6.

NOTE: For procedures in programming the alarm setpoint modes, refer to paragraph G.3.6.

c. If the "System Constant Printout" ("Program Printout") option is used in the system, the setpoint mode of operation selected for each channel may be identified by observing each channel's units indication in the program printout of the alarm setpoints. See Figure G-6B for a typical program printout of the assignable alarm setpoints. The setpoint modes are identified in the printout as follows:

Setpoint Mode	Units Indication
High - Low	PSI
Higher - High	P/m
Lower - Low	P/s

G.3.3.3 ALARM DETECTION

a. Alarms operate on a digital comparison basis. Digitized input data for programmed channels are compared with their digitized alarm setpoint values. *The decimal point is ignored in the comparison routine.* Logic operates when limits are exceeded, and the channels in alarm are indicated in the output record.

b. The alarm comparison routine checks the higher-priority alarm first. If a higher-priority alarm is detected, the alarm indicator is written and the next channel is examined. Therefore, the lower-priority alarm is not checked if there has been a detection of a higher-priority alarm. The alarm comparison check of the lower-priority alarm is done only when there is a legitimate lower-priority alarm existing without a corresponding higher-priority alarm.

Table G-6. Criteria for Selecting Setpoint Modes of Operation.

ASSIGNABLE DUAL SETPOINT			EQUIVALENT CHAN. ADDRESS NO.		SETPOINT MODE SELECTION CODE		
Number	Alarm Priority	Key Control	Channel Pair Programming System[1]	Single Channel Programming System[2]	High-Low Mode Code	Higher-High Mode Code	Lower-Low Mode Code
00	Higher	HIGH ALARM	216	108	Any Number From 0 Thru 9	(A)	(-)
	Lower	LOW ALARM	217				
01	Higher	HIGH ALARM	218	109			
	Lower	LOW ALARM	219				
02	Higher	HIGH ALARM	220	110			
	Lower	LOW ALARM	221				
03	Higher	HIGH ALARM	222	111			
	Lower	LOW ALARM	223				
04	Higher	HIGH ALARM	224	112			
	Lower	LOW ALARM	225				
05	Higher	HIGH ALARM	226	113			
	Lower	LOW ALARM	227				
06	Higher	HIGH ALARM	228	114			
	Lower	LOW ALARM	229				
07	Higher	HIGH ALARM	230	115			
	Lower	LOW ALARM	231				
08	Higher	HIGH ALARM	232	116			
	Lower	LOW ALARM	233				
09	Higher	HIGH ALARM	234	117			
	Lower	LOW ALARM	235				
10	Higher	HIGH ALARM	236	118			
	Lower	LOW ALARM	237				
11	Higher	HIGH ALARM	238	119			
	Lower	LOW ALARM	239				
12	Higher	HIGH ALARM	240	120			
	Lower	LOW ALARM	241				
13	Higher	HIGH ALARM	242	121			
	Lower	LOW ALARM	243				
14	Higher	HIGH ALARM	244	122			
	Lower	LOW ALARM	245				
15	Higher	HIGH ALARM	246	123			
	Lower	LOW ALARM	247				

[1] The higher-priority setpoint value (HIGH ALARM key control) and lower-priority setpoint value (LOW ALARM key control) are individually viewed on display when the equivalent channel address number is selected.

[2] Only the higher-priority setpoint value (HIGH ALARM key control) is viewed on display when the equivalent channel address number is selected.

c. An operational analysis of the alarm detection may be made by referring to Table G-7. For example, if the alarm-programmed parameters for channel 2 are taken from Table G-7, it can be seen that channel 2 has: (1) a setpoint number assignment of 00 (zero) which is providing a higher-priority setpoint value setting of -01000 entered through the control of the HIGH ALARM key; and a lower-priority setpoint value setting of 01000 entered through the control of the LOW ALARM key, and (2) a setpoint mode selection of "Lower-Low" as programmed by the setpoint mode code of minus (-).

d. Using the alarm-programmed parameters of channel 2 as an example, the alarm-comparison checking routine checks the higher-priority alarm first. Since the measured data of -01500 is lower than the setpoint value register of -01000, a higher-priority alarm is detected and the high alarm indicator is written. No comparison check is made of the lower-priority alarm since a detection has been made of the higher-priority alarm. The alarm condition for channel 2 is represented on the display and "Seiko" printer as shown in the "Alarm Indication" column of Table G-7.

> NOTE: The same line of reasoning used for the alarm detection analysis of channel 2 (per example above) may also be applied to the alarm-programmed parameters shown for the other channels in Table G-7.

G.3.4 "CLASS B" ALARM RELAY OUTPUTS

a. The optional alarm relay outputs for the assignable dual-setpoint alarms ("Class B") are provided on a per setpoint basis. Therefore, as many as 32 output relays for the 16 dual setpoints may be employed in a system. If a channel is assigned a particular dual setpoint and either one or the other of the setpoints is exceeded, the appropriate relay will close[1] as follows: (1) if the higher-priority alarm is exceeded, the high-alarm relay closes, and (2) if the lower-priority alarm is exceeded, the low-alarm relay closes.

b. In addition to each individual setpoint relay, a total of three other common-alarm relays may also be used as follows: (1) one common high-alarm relay, (2) one common low-alarm relay, and (3) one common relay for either a high alarm or low alarm. The common high-alarm relay closes whenever any channel exceeds its higher-priority setpoint. The common low-alarm relay closes whenever any channel exceeds its lower-priority setpoint. The common high- or low-alarm relay closes whenever any channel exceeds either its higher-priority or lower-priority setpoint.

c. The location of the output ports for the alarm relays are indicated in Table G-3.

> NOTE: If alarm relay outputs are used, RAMs corresponding to the output port locations must be plugged into their designated sockets. If RAMs that are being used for storage of data are already in these locations, these existing data-storage RAMs can be used without adding more RAMs. However, if RAMs are not found in these locations, the required number of RAMs must be added in the proper locations to supply the output ports for the alarm relays.

d. For additional information regarding the "Class B" alarm relay output configurations, refer to instruction Form #PD-2064ASRO in "Section B" of the Appendix.

G.3.5 PROGRAMMING

a. The assignable setpoint alarms may automatically be programmed into the system operation by the "Custom Program Initialization" option if specified by the user at time of instrument order; or the assignable setpoint alarms may be programmed into the system by direct keyboard entry as given by the programming example under paragraph G.3.6. For description of the "Custom Program Initialization" option, refer to paragraph 3.5.1 in "Section 3" of the manual.

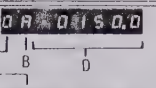
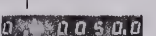
b. If the user has ordered custom initialization of the assignable setpoints, the alarm setpoint specifications are entered on an "Assignable Alarm Setpoint Specification" form (#507PD). The appropriately filled-out specification form is found in the "Technical Data" envelope at rear of manual.

G.3.6 PROGRAMMING EXAMPLE

An example for entering the assignable setpoint alarms into the system operation via the keyboard is given in Figure G-5.

[1]Relay closures respond to the output data and occur after the data scan and output cycle has been completed. Relays remain closed until subsequent channel scans/outputs no longer encounter an "alarm" condition.

Table G-7. Alarm-Detection Analysis Using Various Alarm-Programmed Parameters.

ALARM-PROGRAMMED PARAMETERS									ALARM INDICATION	
		SETPOINT VALUE							On Display (Channel's Memory Storage From Last Scan)	On "Seiko" Printer Output (Channel Data Lines From Output Frame of Last Scan)
CHANNEL NUMBER	SETPOINT NUMBER	Entry for HIGH ALARM key	Entry for LOW ALARM key	SETPOINT MODE	SETPOINT MODE CODE	MEASURED DATA	RANGE CODE	TYPE OF ALARM DETECTED		
2	00	-01000	01000	Lower-Low	(-)	-0150.0	1	Higher Priority		ChOO2 0 : -0150.0 V
3	00	-01000	01000	Lower-Low	(-)	0050.0	1	Lower Priority		ChOO3 0 . 0050.0 V
7	02	25000	15000	Higher-High	(A)	2525.5	1	Higher Priority		ChOO7 2 : 2525.5 V
8	02	25000	15000	Higher-High	(A)	2435.5	1	Lower Priority		ChOO8 2 . 2435.5 V
10	03	12000	-10000	High-Low	(Any number from 0 thru 9)	-150.15	2	Lower Priority		ChO10 3 . -150.15 °F
11	03	12000	-10000	High-Low		140.00	2	Higher Priority		ChO11 3 : 140.00 °F
12	03	12000	-10000	High-Low		-095.00	2	None		ChO12 3 -095.00 °F

DISPLAY AND "SEIKO" PRINTOUT LEGENDS

A-Dual setpoint number code; In addition to being indicated on display, setpoint number code is only outputted to the "Seiko" printer output device when the optional 8-digit data output control program ROM is used. Setpoint number code is omitted from the "Seiko" printer's output record when the standard 7-digit data output control program ROM is used. (NOTE: The optional output control program ROM for 8-digit data output is provided for the "Seiko" printer output device only. It is not available for the other standard output peripherals.)
B-Alarmed condition via HIGH ALARM key setpoint value (Indicator A on display and : on printer)
C-Alarmed condition via LOW ALARM key setpoint value (Indicator .)
D-Channel data
E-Channel number
F-Measurement units
G-No alarm (blank)

(Intentionally Blank.)

GIVEN:

(1) A channel-pair programming system consisting of 24 analog channels.

(2) Input terminals for channels 000 and 001 are tied together and are being used as the reference channel for temperature measurements. All 24 channels (except 000 and 001) are programmed with the 2-character "Alarms" correction function code. See Figure G-6A for the program printout of the system and channel constants.

(3) Tables A and B which list the assignable setpoint specifications.

(4) From Table A, setpoint assignments are as follows: setpoint number 00 is assigned to channels 000-003; setpoint number 01 is assigned to channels 004-006; setpoint number 02 is assigned to channels 007-009; and so forth.

(5) From Table B, setpoint number 00 is to be operated in the "Lower-Low" mode with a higher-priority setpoint value of -01000 and a lower-priority setpoint value of 01000; setpoint number 01 is to be operated in the "High-Low" mode with a higher-priority setpoint value of 35500 and a lower-priority setpoint value of 25000; setpoint number 02 is to be operated in the "Higher-High" mode with a higher-priority setpoint value of 25000 and a lower-priority setpoint value of 15000; and so forth.

Table A. Setpoint Number Assignments.

CHANNEL NUMBER	DUAL SETPOINT NUMBER
023	06
022	06
021	06
020	05
019	05
018	05
017	04
016	04
015	04
014	04
013	03
012	03
011	03
010	03
009	02
008	02
007	02
006	01
005	01
004	01
003	00
002	00
001	00
000	00

Table B. Setpoint Number Characteristics.

DUAL SETPOINT NUMBER	HI ALARM SETPOINT (HIGHER PRIORITY)	LO ALARM SETPOINT (LOWER PRIORITY)	SETPOINT MODE	
			Higher Priority	Lower Priority
00	-01000	01000	Lower - - - - - -	Low
01	35500	25000	High - - - - - -	Low
02	25000	15000	Higher - - - - -	High
03	12000	-10000	High - - - - - -	Low
04	15500	10500	Lower - - - - - -	Low
05	25815	24680	Higher - - - - -	High
06	37870	21316	High - - - - - -	Low

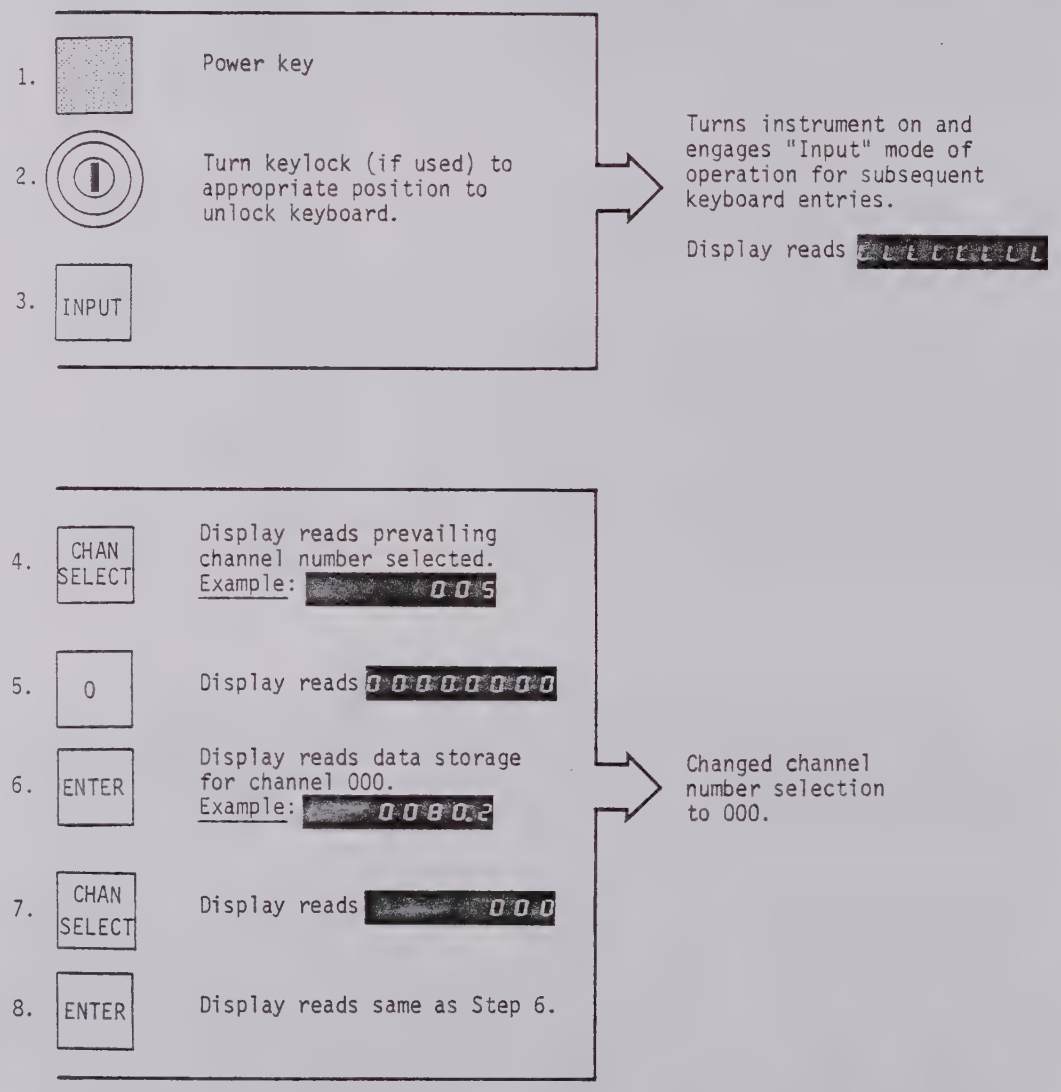
P1510-1

Figure G-5 (Sheet 1 of 7). Keyboard Programming Example of Assignable Setpoint Alarms.

Keyboard Programming (Cont'd)

PROGRAMMING PROCEDURES:

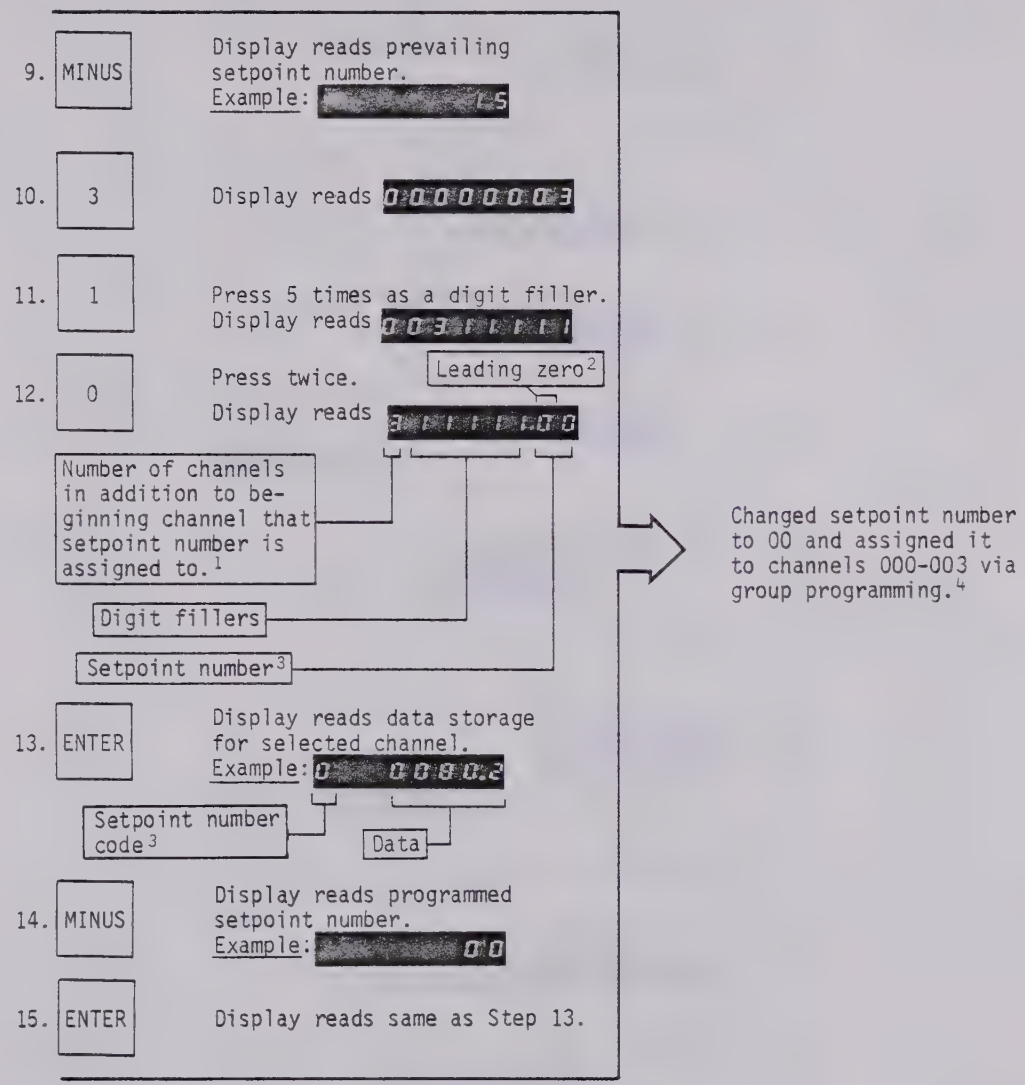
Press following designated keys in sequence shown:



P1510-2

Figure G-5 (Sheet 2 of 7). Keyboard Programming Example of Assignable Setpoint Alarms (Cont'd).

Keyboard Programming (Cont'd)



[1] Maximum additional channels = 9.

[2] Only the numbers 0 and 1 are allowable in this position. As a default condition, the ENTER command will be ignored if any other numbers are entered in this position. Thus, a previous setpoint number specification would remain unchanged.

[3] See Table G-4 for setpoint number codes.

[4] See description of group programming procedures under paragraph 3.5.6 in "Section 3" of manual.

P1510-3

Figure G-5 (Sheet 3 of 7). Keyboard Programming Example of Assignable Setpoint Alarms (Cont'd).

Keyboard Programming (Cont'd)

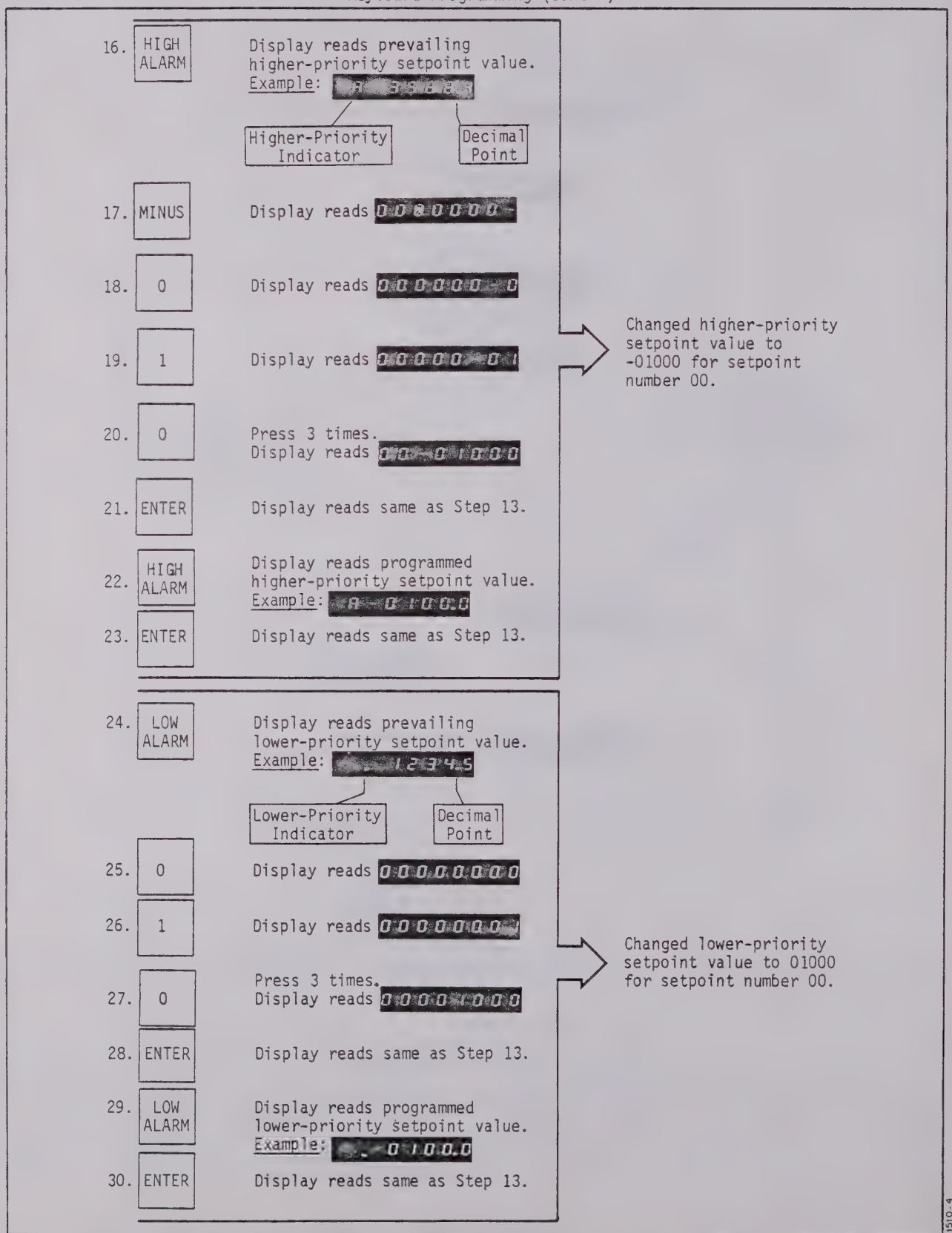
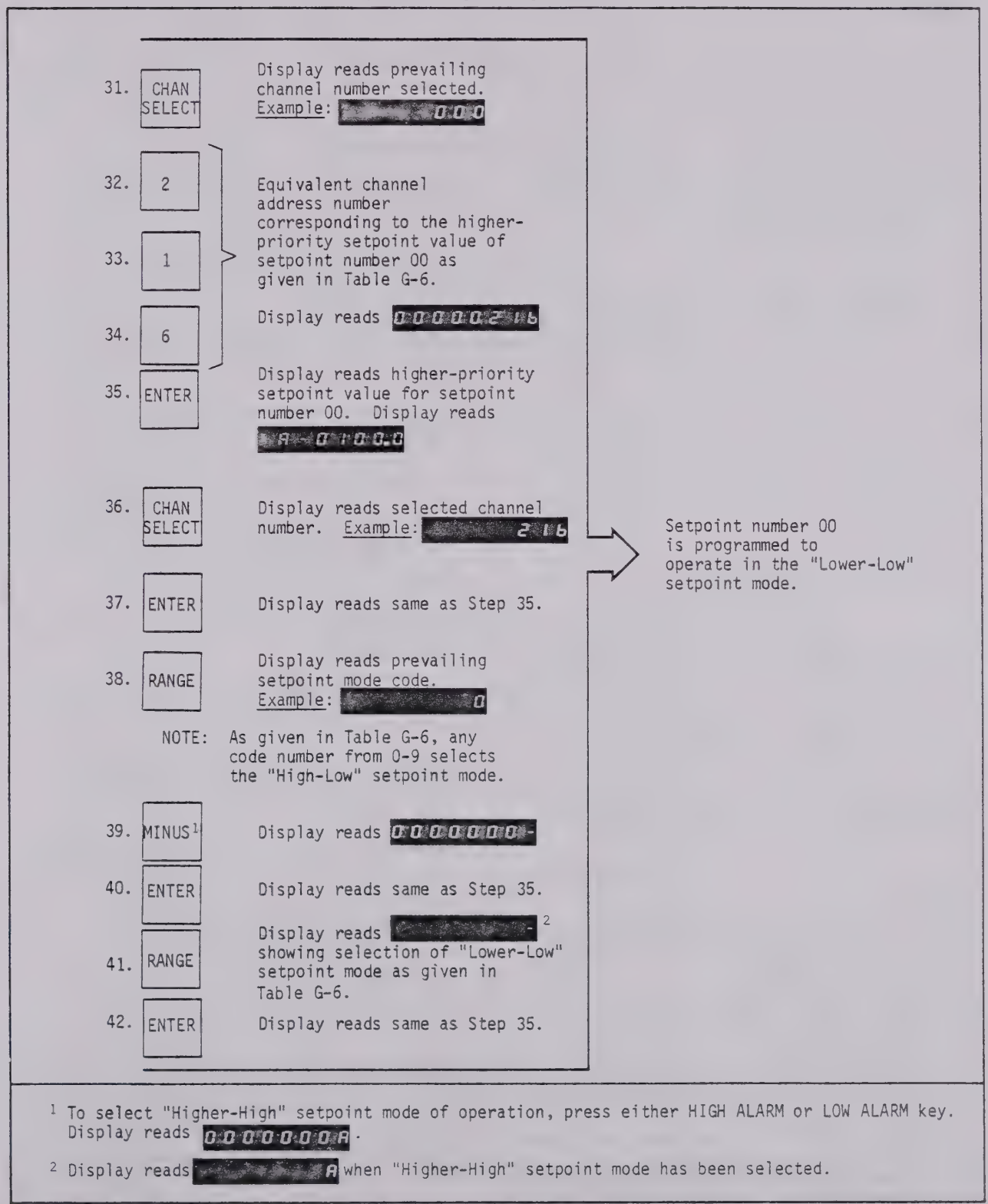


Figure G-5 (Sheet 4 of 7). Keyboard Programming Example of Assignable Setpoint Alarms (Cont'd).

Keyboard Programming (Cont'd)


31. CHAN SELECT
Display reads prevailing channel number selected. Example: 000
32. 2
33. 1
Equivalent channel address number corresponding to the higher-priority setpoint value of setpoint number 00 as given in Table G-6.
Display reads 000026
34. 6
35. ENTER
Display reads higher-priority setpoint value for setpoint number 00. Display reads A 0100.0
36. CHAN SELECT
Display reads selected channel number. Example: 216
37. ENTER
Display reads same as Step 35.
38. RANGE
Display reads prevailing setpoint mode code. Example: 0
NOTE: As given in Table G-6, any code number from 0-9 selects the "High-Low" setpoint mode.
39. MINUS[1]
Display reads 00000000-
40. ENTER
Display reads same as Step 35.
41. RANGE
Display reads -[2] showing selection of "Lower-Low" setpoint mode as given in Table G-6.
42. ENTER
Display reads same as Step 35.
Setpoint number 00 is programmed to operate in the "Lower-Low" setpoint mode.

[1] To select "Higher-High" setpoint mode of operation, press either HIGH ALARM or LOW ALARM key. Display reads 00000000A.

[2] Display reads A when "Higher-High" setpoint mode has been selected.

P1510-5

Figure G-5 (Sheet 5 of 7). Keyboard Programming Example of Assignable Setpoint Alarms (Cont'd).

Keyboard Programming (Cont'd)

43. Following procedural principles outlined in Steps 4-8, select channel number 004.

44. Following procedural principles outlined in Steps 9-15, select setpoint number 01; and assign setpoint number 01 to channels 004-006 via group programming.

45. Following procedural principles outlined in Steps 16-23, set the higher-priority setpoint value to 35500 for setpoint number 01.

46. Following procedural principles outlined in Steps 24-30, set the lower-priority setpoint value to 25000 for setpoint number 01.

47. Following procedural principles outlined in Steps 31-42, program setpoint number 01 to operate in the "High-Low" setpoint mode.

48. Repeat Step 43 for selecting channel number 007.

49. Repeat Step 44 for selecting setpoint number 02 and its assignment to channels 007-009 via group programming.

50. Repeat Step 45 for setting the higher-priority setpoint value to 25000 for setpoint number 02.

51. Repeat Step 46 for setting the lower-priority setpoint value to 15000 for setpoint number 02.

52. Repeat Step 47 for programming setpoint number 02 to operate in the "Higher-High" setpoint mode.

53. Repeat Step 43 for selecting channel number 010.

54. Repeat Step 44 for selecting setpoint number 03 and its assignment to channels 010-013 via group programming.

55. Repeat Step 45 for setting the higher-priority setpoint value to 12000 for setpoint number 03.

56. Repeat Step 46 for setting the lower-priority setpoint value to -10000 for setpoint number 03.

57. Repeat Step 47 for programming setpoint number 03 to operate in the "High-Low" setpoint mode.

58. Repeat Step 43 for selecting channel number 014.

59. Repeat Step 44 for selecting setpoint number 04 and its assignment to channels 014-017 via group programming.

60. Repeat Step 45 for setting the higher-priority setpoint value to 15500 for setpoint number 04.

61. Repeat Step 46 for setting the lower-priority setpoint value to 10500 for setpoint number 04.

62. Repeat Step 47 for programming setpoint number 04 to operate in the "Lower-Low" setpoint mode.

63. Repeat Step 43 for selecting channel number 018.

64. Repeat Step 44 for selecting setpoint number 05 and its assignment to channels 018-020 via group programming.

65. Repeat Step 45 for setting the higher-priority setpoint value to 25815 for setpoint number 05.

66. Repeat Step 46 for setting the lower-priority setpoint value to 24680 for setpoint number 05.

67. Repeat Step 47 for programming setpoint number 05 to operate in the "Higher-High" setpoint mode.

68. Repeat Step 43 for selecting channel number 021.

69. Repeat Step 44 for selecting setpoint number 06 and its assignment to channels 021-023 via group programming.

70. Repeat Step 45 for setting the higher-priority setpoint value to 37870 for setpoint number 06.

71. Repeat Step 46 for setting the lower-priority setpoint value to 21316 for setpoint number 06.

72. Repeat Step 47 for programming setpoint number 06 to operate in the "High-Low" setpoint mode.

P1510-6

Figure G-5 (Sheet 6 of 7). Keyboard Programming Example of Assignable Setpoint Alarms (Cont'd).

Keyboard Programming (Cont'd)

PRINTOUTS ON "SEIKO" PRINTER

73. Obtain a program printout[1] of the system and channel constants as follows:

    (a) Press any one of the channel constant keys (I-O, CORR FUNCT, RANGE, or UNITS) either once or twice until display reads all L's.

    (b) Press MINUS key, and then press MAN REC key to obtain the printout shown in Figure G-6A.

74. Obtain a program printout[1] of the assignable setpoints[2] as follows:

    (a) Repeat Step 73a.

    (b) Press either HIGH ALARM or LOW ALARM key, and then press MAN REC key to obtain the printout shown in Figure G-6B.

75. Press MAN REC key to obtain the channel frame printout shown in Figure G-6C.

[1] Printout is obtainable only if system is equipped with the "System Constant Printout" ("Program Printout") option described under paragraph 3.5.2 in "Section 3" of the manual.

[2] Only the dual setpoints that have been assigned to channels are outputted. Any unassigned dual setpoints that remain in storage are not outputted.

P1510-7

Figure G-5.(Sheet 7 of 7). Keyboard Programming Example of Assignable Setpoint Alarms (Cont'd).

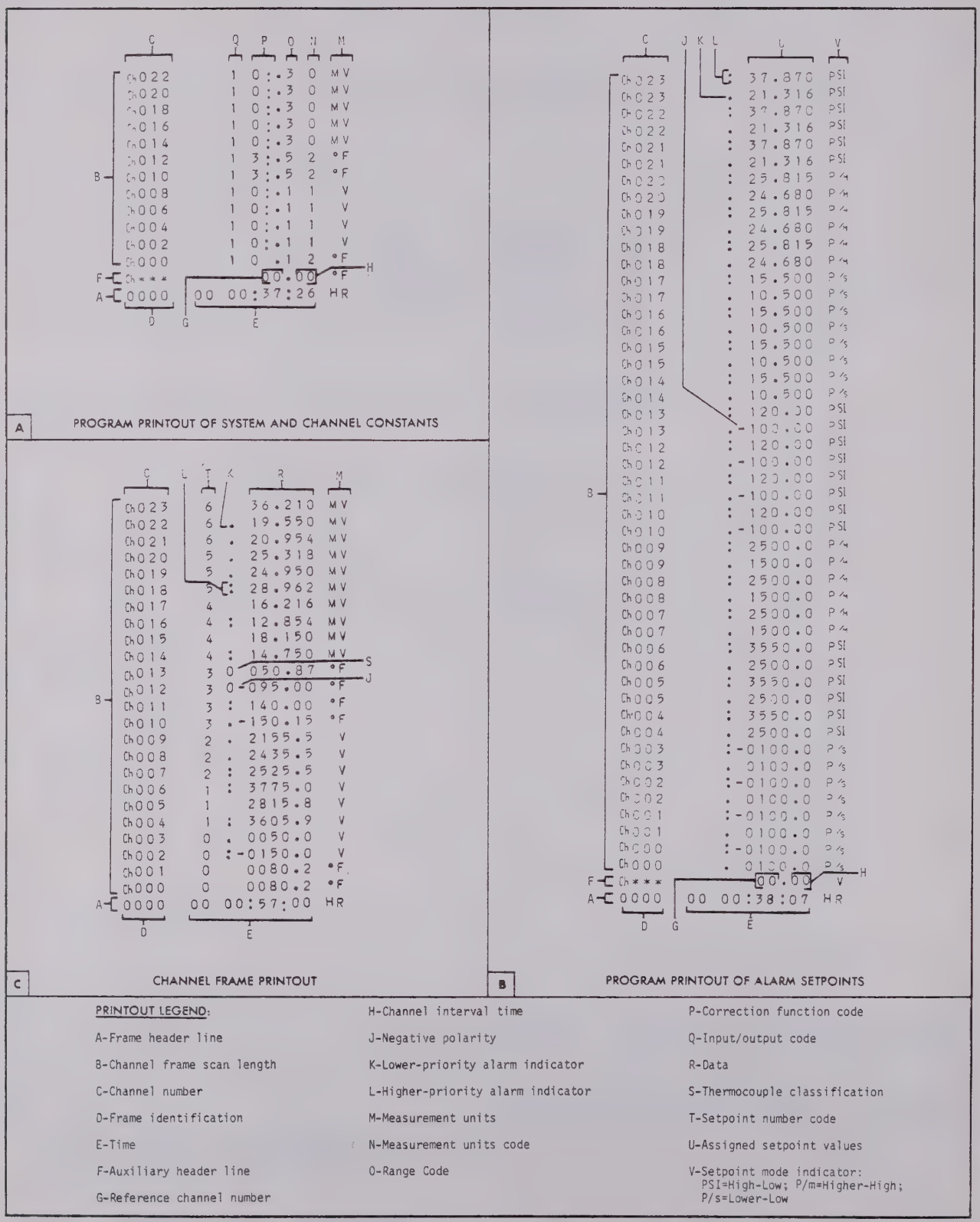


Figure G-6. Printouts on "Seiko" Printer Using Programming Example of Figure G-5.

G.4 "MULTI-CONDITIONAL ALARM OUTPUT" OPTION

G.4.1 GENERAL

a. This alarm output option program provides the system with 10 different programmable operating modes which control the alarm output functions. Although 10 modes are available for selection, only one operational mode at a time can be programmed into the system. Refer to Table G-9 for a description of the various modes.

b. In addition to the 10 alarm output modes, 3 other selectable modes (#'s 11, 12, and 13 in Table G-9) may be used to defeat the multi-conditional alarm output function so that system operation may be reverted to one of its basic modes.

G.4.2 ROM REQUIREMENTS

The plug-in ROM requirements for the multi-conditional alarm output option depend upon the type of alarm setpoint configuration that is used in the system. For a breakdown of the "Class A" and "Class B" alarm system configurations, refer to Table 3-1 in "Section 3" of the manual. The ROM requirements may be determined by referring to Table G-8.

G.4.3 OPERATIONAL ASPECTS

G.4.3.1 MODE SELECTION

a. The alarm output mode selection is programmed into the system via the 4-digit, channel frame identification number (ID). The ID number is programmed via the ID key control and appropriate entry from the keyboard. See programming procedures under paragraph G.4.4.

b. The programmable ID number consists of 4 digits as shown in Figure G-7. The two most significant digits of the ID number (MSD and MSD-1) control the mode selection. The two least significant digits of the ID number (LSD and LSD-1) have no operational effect.

c. As shown in Table G-9, the programmed ID numbers for MSD code specifications of A0 through A7 (modes 1 through 8) provide 2 different scanning rates--a main interval scan rate (SCAN INTVL key control) and a subinterval scan rate (CHAN INTVL key control). Refer to Table G-9 for a descriptive analysis of the various programmed operational modes.

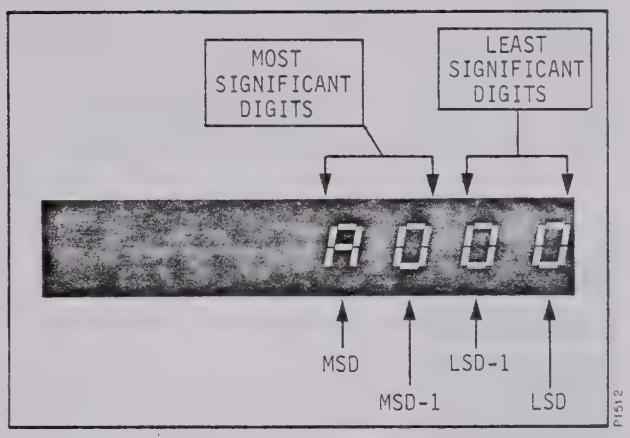


Figure G-7. Typical Programmed ID Number Showing MSD Specification of "A0" (Mode #1 Selection).

G.4.3.2 MAIN SCAN TIMING

a. The main scan interval rate is controlled by the normal functions of the SCAN INTVL key and appropriate entry from the keyboard to provide a time delay interval between channel frame scans in increments of days, hours, minutes, and seconds.

b. The time delay interval in scanning between channels (via CHAN INTVL key control) is defeated so that channels are always scanned at the maximum rate.

G.4.3.3 SUBINTERVAL SCAN TIMING

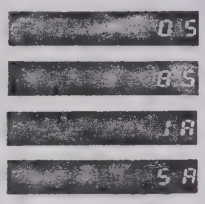
a. When the multi-conditional alarm output option is used, the normal time delay interval in the scanning rate between channels (CHAN INTVL key control) is defeated. Instead, the function of the CHAN INTVL key now provides a time delay interval (in seconds or minutes) between the subinterval scans. At time of a subinterval frame scan, channels are scanned at the maximum rate (no time delay between channels).

b. The timing between subinterval scans is not precise. It includes the time delay interval plus the scanning and outputting time for each subinterval cycle. The timing between main interval scans, however, is precise and can interrupt a subinterval scan or output.

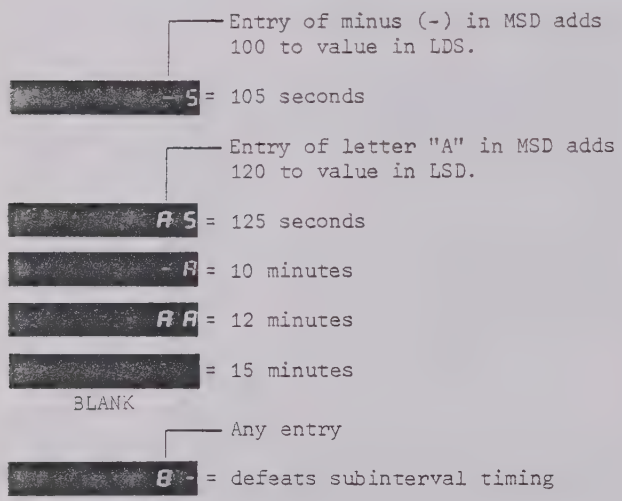
c. The subinterval timing may be programmed in either seconds or minutes via the CHAN INTVL key control and appropriate entry from the keyboard. To provide seconds delay timing, two numeric digits (0-99 seconds) are entered for the subinterval timing. To provide minutes delay timing, a numeric value (0-9 minutes) is entered

in the MSD of the subinterval timing; and the letter "A" (HIGH ALARM or LOW ALARM key entry) is placed in the LSD of the subinterval timing.

d. Examples of programmed subinterval timing are as follows:



e. Special entries which do not adhere to the normal procedures of programming the subinterval timing are given below for reference.


Entry of minus (-) in MSD adds 100 to value in LDS.
= 105 seconds
Entry of letter "A" in MSD adds 120 to value in LSD.
= 125 seconds
= 10 minutes
= 12 minutes
= 15 minutes
BLANK
Any entry
= defeats subinterval timing

G.4.4 PROGRAMMING

The multi-conditional alarm output option may be programmed into the system by direct keyboard entry as follows:

(1) To program the system's operational mode (per Table G-9), program the desired ID number by following the procedural principles outlined under Section 1.2.1 on the left-hand, foldout sheet of the "Operational Flow Diagram" (located at end of "Operation" section in manual).

(2) To program the desired main scan interval rate into the system, follow procedural principles for programming of the scan interval timing (SCAN INTVL key control) outlined under Section 2 on the left-hand, foldout sheet of the "Operational Flow Diagram".

(3) To program the desired subinterval timing delay into the system, follow procedural principles for programming of the channel interval delay timing (CHAN INTVL key control) outlined under Section 2 on the left-hand, foldout sheet of the "Operational Flow Diagram"; and also refer to paragraph G.4.3.3c for method of selecting either seconds timing or minutes timing.

Table G-8. ROM Requirements for Multi-Conditional Alarm Output Option.

TYPE OF ALARM SETPOINT CONFIGURATION USED:	ROM PROGRAMS USED:[3]				
	ROM 3	ROM 7	ROM 8	ROM 10[5]	ROM 15[6]
Class "A" (Setpoints are assignable per certain fixed channels in system)[1]	ROM130203001	ROM130207013	Any standard alarm ROM[4] (for example, ROM130208002)	ROM130210013	Optional digital input program (if used)
Class "B" (Setpoints are assignable per any channel in system--"Assignable Dual-Setpoint Alarm" option)[2]	ROM130203002	ROM130207020	ROM130208021	ROM130210020	ROM130215020

[1]Incorporation of the multi-conditional alarm output option with the "Class A" alarm setpoint configuration precludes the use of other standard options which require the program functions of ROMs 7 and 10.

[2]Incorporation of the multi-conditional alarm output option with the "Class B" alarm setpoint configuration precludes the use of other standard options which require the program functions of ROMs 7, 8, 10, and 15.

[3]For location of ROM positions on CPU card, refer to Figure 1-3 in "Section 1" of manual.

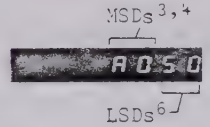
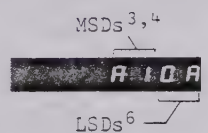
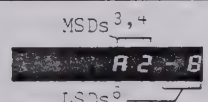
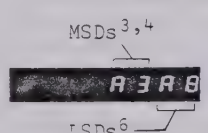
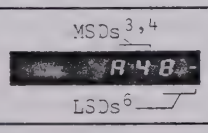
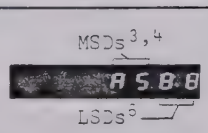
[4]"POCAS" (Print-Only-on-Change-of-Alarm Status) ROM program is not compatible with the multi-conditional alarm output option.

[5]Only 3 thermocouple ranges (instead of maximum of 4) are available when system incorporates the multi-conditional alarm output option.

[6]In standard design systems, the digital input option cannot be incorporated in systems when the multi-conditional alarm output option and the assignable dual-setpoint alarm option are both included in the same system. However, systems can be specially devised on a custom basis to include digital inputs with this combination of options. Consult factory.

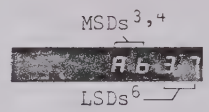
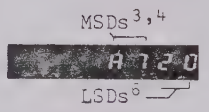
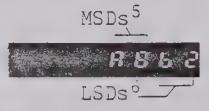
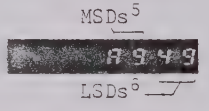
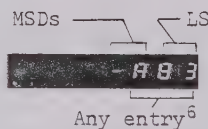
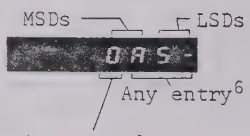
(Intentionally Blank.)

Table G-9. Programmable Operational Modes of Multi-Conditional Alarm Output Option.

MODE NO.	PROGRAMMED ID NUMBERS	MODE DESCRIPTION	
		Main Interval Channel Scans[1]	Subinterval Channel Scans[2]
1		All channels (per I-0 code) are outputted. Channels in-alarm, as well as channels not-in-alarm, are indicated in the output record.	All channels (per I-0 code) are outputted whenever any channel is detected in the alarm condition. Channels in-alarm, as well as channels not-in-alarm, are indicated in the output record.
2		Same as Mode #1 description above.	All channels (per I-0 code) are outputted whenever any channel is detected in a change-of-special-condition[8]. Channels that have undergone a change-of-special-condition from previous output, as well as channels that have not undergone a change-of-special-condition from previous output, are indicated in the output record. A change-of-special-condition can be any one of the following: (a)Channel data changes from a "within range" condition to an "overrange" condition, or vice versa. (b)Channel data changes from a non-alarm condition to either a high- or low-alarm condition, or vice versa. (c)Channel data changes from a high-alarm condition to a low-alarm condition, or vice versa. (d)Channel data changes from an overrange condition to either a high- or low-alarm condition, or vice versa.
3		Same as Mode #1 description above.	Only channels that are detected in the alarm condition are outputted per I-0 code.
4		Same as Mode #1 description above.	Only channels that are detected in a change-of-special-condition[8] from previous output are outputted per I-0 code. See listing of "special condition" factors (a-d) described above for Mode #2.
5		Only channels that are detected in the alarm condition are outputted per I-0 code.	Same as Mode #1 description above.
6		Same as Mode #5 description above.	Same as Mode #2 description above.

1,2,3,4,6,8(See footnotes at end of table.)

Table G-9. Programmable Operational Modes of Multi-Conditional Alarm Output Option. (Cont'd.)

MODE NO.	PROGRAMMED ID NUMBERS	MODE DESCRIPTION	
		Main Interval Channel Scans [1]	Subinterval Channel Scans [2]
7		Same as Mode #5 description above.	Same as Mode #3 description above.
8		Same as Mode #5 description above.	Same as Mode #4 description above.
9		Same as Mode #5 description above.	None.
10		Same as Mode #4 description given above for the "Sub-interval Channel Scans".	None.
11		Multi-conditional alarm output function is defeated. System continuously scans and outputs to devices according to the programmed I-O codes. See operational description of this mode under paragraph 3.5.5 in "Operation" section of manual. This mode ("Continuous Print" or "Continuous Record") is programmed into the system via keyboard programming Section 1.2.2 on left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual). Display remains blanked out during the "Continuous Print" ("Continuous Record") mode. This mode can be set into operation by any one of the following methods: (a) automatically via the programmed "Next Scan" time while system is engaged in either the "Auto" or "Input" mode; (b) manually by pressing the MAN REC key while system is engaged in the "Input" mode; (c) remotely via a "Remote Scan Trigger" signal (low signal on pin 22 of the optional Remote Control Connector) while system is engaged in the "Auto" mode.	
12		Multi-conditional alarm output function is defeated. System reverts to normal scanning[7] and outputting mode (per I-O code) whereby scans can be triggered by any one of the following methods: (a) automatically via the programmed "Next Scan" time, and subsequently thereafter by the programmed "Scan Interval" time while system is engaged in either the "Auto" or "Input" mode; (b) manually by pressing the MAN REC key while system is engaged in the "Input" mode; (c) remotely via a "Remote Scan Trigger" signal (low signal on pin 22 of the optional Remote Control Connector) while system is engaged in the "Auto" mode. The display reads prevailing clock time after outputting operations when system is engaged in the "Input" mode. Display remains blanked out after an output operation when system is engaged in the "Auto" mode. The normal scanning and output mode is programmed into the ID number (via ID key control) by following procedures under the keyboard programming Section 2 on the left-hand, foldout sheet of "Operational Flow Diagram" (located at end of "Operation" section in manual).	

[1,2,3,4,5,6,7] (See footnotes at end of table.)

Table G-9. Programmable Operational Modes of Multi-Conditional Alarm Output Option. (Cont'd.)

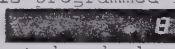
MODE NO.	PROGRAMMED ID NUMBERS	MODE DESCRIPTION
13	BLANK ID  A blank ID number can be programmed from keyboard by clearing an ID number with CLEAR ENTRY key, and then pressing the ENTER key.	Same as Mode #12 description given above with the exception that display reads initial load point (all L's) instead of the clock time after an output operation has been made with system engaged in the "Input" mode (display is blanked out if in the "Auto" mode).

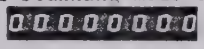
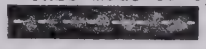
Table G-9 Footnotes:

[1] The main interval channel scans can be triggered by any one of the following methods: (a) automatically via the programmed "Next Scan" time, and subsequently thereafter by the programmed "Scan Interval" time while system is engaged in either the "Auto" or "Input" mode; (b) manually by pressing the MAN REC key while system is engaged in the "Input" mode; (c) remotely via a "Remote Scan Trigger" signal (low signal on pin 22 of the optional Remote Control Connector) while system is engaged in the "Auto" mode.

A main interval channel scan has priority and will interrupt a subinterval channel scan. When a subinterval scan is interrupted with a main interval scan, the programmed timing delay (minutes or seconds) between subinterval scans returns to zero and starts the subinterval timing over again.

[2] The subinterval channel scan can be triggered by any one of the following methods: (a) automatically initiated at the subinterval rate after a main interval channel scan has been made. Subinterval channel scans are made according to the subinterval rate in seconds or minutes as programmed by CHAN INTVL key control; (b) remotely via a "Channel Interval Override" signal (low signal on pin 6 of the optional Remote Control Connector) while system is engaged in the subinterval scanning mode.

NOTE: If a minus sign (-) is programmed into the LSD of the channel interval (subinterval) delay time (Example: ), the delay time which determines the subinterval scanning rate is defeated and places an unlimited time period over which the system may remain in the subinterval mode without any scans taking place (except when interrupted by the main interval channel scans). Under this condition, applying a "Channel Interval Override" signal (low signal on pin 6 of the optional Remote Control Connector) during the subinterval scanning mode (time period between main interval scans) initiates a subinterval scan and thus establishes a remote subinterval scanning rate dependent upon the occurrences of the "Channel Interval Override" signal.

[3] For MSD code specifications of A0 through A7, the main interval scanning mode may be defeated so that the subinterval scanning mode only is retained. This mode of operation may be obtained by entering all zeroes  or all minuses  for the "Next Scan" time.

Therefore, after the multi-conditional alarm output function has once been initialized (by one of the methods given under footnote 1), the system remains in the subinterval scanning mode and scans are made at the subinterval rate. The system remains in the subinterval scanning mode unless or until it is manually interrupted by pressing the HALT key.

[4] The display remains blanked out after outputting operations for MSD code specifications of A0 through A7.

Table G-9 Footnotes (Cont'd).

[5] If the "Class A" alarm setpoint configuration is used (setpoints are assignable per certain fixed channels in system), the MSD code specification of A8 or A9 causes the display to indicate the total number of channels that have been outputted in the alarm condition--provided the instrument is engaged in the "Input" mode (display is blanked out if in the "Auto" mode).

If the "Class B" alarm setpoint configuration is used (setpoints are assignable per any channel in system), the MSD code specifications of A8 or A9 causes the display to read the prevailing clock time after an output operation--provided the instrument is engaged in the "Input" mode (display is blanked out if in the "Auto" mode).

[6] The letter "A", a minus sign (-), or any number may be indiscriminantly entered in these digit positions without affecting the operational mode.

[7] Channel interval delay time remains defeated. Channel scans are made at maximum rate (no delay time between channels).

[8] The change-of-special-condition indication is placed in the eight bit of the special condition code during the scanning time. If a particular channel is monitored (after a HALT key operation) via the CHAN READ key control and is in the process of undergoing a change-of-special-condition, the MSD-1 position (special condition character) on the display may read a special condition code that is 8 less in value than the existing or actual change-of-special-condition code (stored in memory) that was outputted for this channel in the 7th digit position on the "Seiko" printer from the previous output.

The special condition codes are as follows:

SPECIAL CONDITION CODE		CHARACTER VIEWED IN MSD-1 POSITION ON DISPLAY	CHARACTER PRINTED IN 7TH DIGIT POSITION ON "SEIKO" PRINTER
Code	Special Condition		
0¶	Not Applicable	0	0
8	Not Applicable	8	8
9	Not Applicable	9	9
10	Not Applicable	-	-
11	Low Alarm	.	.
12	High Alarm	A	:
13	Invalid Correction Function Code	'	Ch
14	Overrange	L	*
15	None	Blank	Blank

¶ If thermocouple inputs are included in a system which employs the multi-conditional alarm output option, the normal thermocouple special condition code of zero (0) for a no-alarm condition is automatically changed to a code of 15 for a no-alarm condition.

MANUAL CHANGES

ESTERLINE ANGUS
AN ESTERLINE COMPANY

INSTRUMENT DATA SHEET — CUSTOMIZED SPECIFICATIONS

(KITS: 734A71)

MODEL PD-2064 KEY PROGRAMMABLE DATA ACQUISITION SYSTEM

1. GENERAL INFORMATION: SOLD TO: G.T.E. Sylvania Incorp
Mt. View, Calif.
S. O. • M65592A ; P. O. • CD-02928 ; DATE: 1-28-77
FOR USE BY:

2. POWER REQUIREMENTS: VOLTS AC: 120 ; FREQUENCY 60 ; OTHER:

3. CASE STYLE: [ ] BENCH; [X] RACK/PANEL; [X] RACK SLIDES; COLOR: [X] Gray; [ ] Red; [ ] HANDLES; [ ] CARRYING CASE; OTHER:

4. SYSTEM OPTIONS: CRYSTAL CLOCK: Standard [X]; High Stability [ ]; SINGLE CHANNEL PROGRAMMING [ ]; CHANNEL PAIR PROGRAMMING [X];
INTERNAL VOLTAGE REF. SOURCE [ ]; MEMORY SAVE [ ]; REMOTE CONTROL CONNECTOR [ ]; SYSTEM CONSTANT PRINTOUT [ ]; CUSTOM INIT. OF SYS. OPER. [ ];
CUSTOM INIT. OF ALARM SETPOINTS [ ]; AUTO RANGING [ ]; SCAN & DISPLAY [ ]; DUAL-RATE OUTPUT [ ]; INTEGRATOR DUAL-RATE RESET/SCAN [ ];
DIGITAL AVERAGING [ ]; SYSTEM PROGRAM STORAGE BANK [ ]; OTHER:

5. SIGNAL INPUT/MEASURING OPTIONS: MAIN CHASSIS: 64 Analog Channels; _____ Digital Channels;
MAIN CHASSIS EXPANDABLE TO: NA
EXPANDER CHASSIS (1 [ ] or 2 [ ]): _____ Analog Channels; _____ Digital Channels; (See PD-2064 "Expander" Data Sheet)
EXPANDER CHASSIS EXPANDABLE TO:
SIGNAL INPUT TERMINALS: [ ] Solder Type; [X] Screw Type; [ ] ACTUATIONS: [X] MV; [ ] Voltage Divider; [ ] MA; [ ] TC; OFFSET ZERO RANGE [ ]

TC TYPES:	Type E: [ ] °F; [ ] °C	Type J: [X] °F; [ ] °C	Type K: [ ] °F; [ ] °C	Type T: [ ] °F; [ ] °C	Type R: [ ] °F	Type S: [ ] °F.

INTEGRATOR [ ]: No. of Channels Integrated _____ (See PD-2064 "Analog Integrator" Data Sheet)
OTHER:

6. OUTPUT OPTIONS:

OUTPUT INTERFACE OPTIONS:	#1 Output Interface Type: Seiko; [X] Int. or Ext. [ ] Output Device Supplied: ~~Parity~~ ___; ~~Baud Rate~~ ___; ~~Power~~: ___	
	#2 Output Interface Type: _____; [ ] Int. or Ext. [ ] Output Device Supplied: Parity ___; Baud Rate ___; Power: ___	

7. ALARM OPTIONS:

ALARM SETPOINTS ASSIGNED PER CERTAIN FIXED CHANNELS	No. of Channels 64; Single Setpoint/Channel [ ]; Dual Setpoints/Channel [X]; Common Setpoints/Channels [ ] ALARM RELAY OUTPUT [ ]: No. of Channels ___; [ ] One Relay Output per Channel; [ ] One Common Relay Output; Outputs on Main Chassis [ ]; Outputs on Expander Chassis [ ]; MULTI-CONDITIONAL ALARM OUTPUT [ ]
ALARM SETPOINTS ASSIGNED TO ANY CHANNEL (ASSIGNABLE DUAL SETPOINTS)	Number of Dual Setpoints _____ (Expandable to Maximum of 16 Dual Setpoints) ALARM RELAY OUTPUT [ ]: One Relay Output/Setpoint [ ]; Three Common Relay Outputs [ ]; Outputs on Main Chassis [ ]; Outputs on Expander Chassis [ ]; MULTI-CONDITIONAL ALARM OUTPUT [ ]

OTHER:

8. SYSTEM EXPANSION: PRE-WIRED FOR EXPANSION [ ]; EXPANDER CHASSIS SUPPLIED: 1 [ ] or 2 [ ]; (See PD-2064 "Expander" Data Sheet)
OTHER:

9. INSTRUCTIONS & DRAWINGS: INSTRUCTION MANUAL: M734R1-1; INSTRUCTION SUPPLEMENTS: _____
ADDITIONAL MANUAL DRAWINGS: _____

10. SPECIAL FEATURES: _____

11. CHANNEL CONSTANT PROGRAMMING CODES:

INPUT-OUTPUT (I-O) CODE			CORRECTION FUNCTION CODE				RANGE/GAIN CODE			UNITS CODE		
				Correction Function							Seiko Printer As Output Device #1	Output Device #2
Code	Input	Output	Code	Name	Range Code	Units Code	Code	Range	Gain	Code		
0	Analog	Skip	0*	None			0			0	MV	
1	Analog	Device #1	1*				1	4000 MV	1	1	V	
2	Analog	Device #2	2*				2	400 MV	10	2	°F	
3	Analog	Devices #1 & 2	3*				3	40 MV	100	3	°C	
4	Digital	Skip	4*	J	6	2	4			4	PSI	
5	Digital	Device #1	5*				5			5	P/M	
6	Digital	Device #2	6*				6	J °F	43	6	R/M	
7	Digital	Devices #1 & 2	7*				7			7	[illegible]	
8	Stop Scan		8	Not Applicable			8	Not Appl.	Not Appl	8	Hz	
9	Stop Output		9	Not Applicable			9	Not Appl	[illegible]	9	HR	

* Letter "A" Suffix Added to Code Number to Form 2-Character Code for "All" Correction Function (i.e. 0A, 1A, 2A, etc.)

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ESTERLINE ANGUS
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INSTRUMENT DATA SHEET — CUSTOMIZED SPECIFICATIONS

PD-2064 MEMORY SPECIFICATIONS AND LOCATIONS

CPU CARD

ROM INSTALLATION (Refer to G Drawing for any Variation in ROM Programs)				RAM INSTALLATION		
Position ✓	Position ROM #	E.A. Part Number	Program Function	Position ✓	Position Z #	E.A. Part Number
(✓)	0	130200001	System Initialization	(✓)	23	MOS4002-1
(✓)	1	130201001	Subroutines	(✓)	24	MOS4002-1
(✓)	2	130202001	Start Initialization	(✓)	25	MOS4002-2
(✓)	3	130203001	System Variables	(✓)	26	MOS4002-2
( )	4	---------	Custom Initialization	(✓)	27	MOS4002-1
( )	5	130205003	Output Device No. 1 (Seiko)	(✓)	28	MOS4002-1
( )	6	130206___	Output Device No. 2 (---------)	(✓)	29	MOS4002-2
(✓)	7	130207001	A/D Control (Read)	(✓)	30	MOS4002-2
(✓)	8	130208003	Alarms	(✓)	31	MOS4002-1
( )	9	130209___	System Constant (Program) Printout	( )	32	MOS4002-1
( )	10	130210___	----------	( )	33	MOS4002-2
( )	11	130211___	Thermocouple Linearization	( )	34	MOS4002-2
(✓)	12	130212003	Thermocouple Linearization			
( )	13	130213___	Thermocouple Linearization			
( )	14	130214001	Thermocouple Common Linearization			
( )	15	130215___	Digital Input Control			

RAM EXPANSION CARD

RAM INSTALLATION					
Position ✓	Position Z#	E.A. Part Number	Position ✓	Position Z#	E.A. Part Number
( )	1	MOS4002-1	(✓)	2	MOS4002-2
( )	3	MOS4002-1	(✓)	4	MOS4002-2
(✓)	5	MOS4002-1	(✓)	6	MOS4002-2
(✓)	7	MOS4002-1	(✓)	8	MOS4002-2
(✓)	9	MOS4002-1	(✓)	10	MOS4002-2
(✓)	11	MOS4002-1	(✓)	12	MOS4002-2
(✓)	13	MOS4002-1	(✓)	14	MOS4002-2
(✓)	15	MOS4002-1	(✓)	16	MOS4002-2
(✓)	17	MOS4002-1	( )	18	MOS4002-2
(✓)	19	MOS4002-1	( )	20	MOS4002-2

SYSTEM PROGRAM STORAGE BANK CARD

RAM INSTALLATION								
Position ✓	Position Z#	E.A. Part Number	Position ✓	Position Z#	E.A. Part Number	Position ✓	Position Z#	E.A. Part Number
( )	1	MOS5101-L	( )	7	MOS5101-L	( )	11	MOS5101-L
( )	2	MOS5101-L	( )	8	MOS5101-L	( )	12	MOS5101-L
( )	3	MOS5101-L	( )	9	MOS5101-L	( )	13	MOS5101-L
( )	4	MOS5101-L	( )	10	MOS5101-L	( )	14	MOS5101-L
( )	5	MOS5101-L				( )	15	MOS5101-L
( )	6	MOS5101-L				( )	16	MOS5101-L

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Form #327 (Sheet 2 of 3)

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INSTRUMENT DATA SHEET — CUSTOMIZED SPECIFICATIONS

LISTING OF PD-2064 MAJOR ELECTRICAL ASSEMBLIES

P.C. CARD(BOARD) ASSEMBLIES

STANDARD				OPTIONAL			
Qty.	E.A. Part Number	Rev. Level	Name	Qty.	E.A. Part Number	Rev. Level	Name
(1)	734C4-4	D	Analog Input Mother	(1)	734C27-4	C	Aux. Analog Input Mother
(1)	734C1-4	C	Analog Power Supply	( )	734C140-		Common Only Output Relay (No Card Cage)
(1)	734C8-5	E	CPU	( )	734C22-4		Digital Input Control
(1)	734C134-4		Digital Mother	( )	734C23-4		Digital Input Mother
(1)	734C2-5rc	H	Input Amplifier	( )	734C24-4		Digital Input Mux
(1)	734C20-6		Keyboard	( )	734C67-		Output Relay
(1)	734C18-5	H	Logic Power Supply	( )	734C67-		Output Relay
(8)	734C21-4	C	Relay Mux	( )	734C67-		Output Relay
(1)	734C135-4		System Control	( )	734C40-4		Parallel Interface
				(1)	734C10-5	A	Printer Interface
				(1)	734C11-5	E	RAM Expansion
				( )	734C63-4		RS-232 Interface
				( )	734C25-5		TTY Interface
				( )	734C138-		System Program Storage Bank

INTERNAL INTERCONNECTING CABLES

Qty.	E.A. Part Number	From . . . . . .To
(1)	73A50-7	Analog Input Mother Board (J14) to Auxiliary Mother Board (J5)
( )	73A50-8	Output Relay Card (J1) to CPU Card or RAM Expansion Card
(1)	734B35	Analog Input Mother Board (P2) to Auxiliary Mother Board (P1)
( )	734B36	Digital Input Mother Board (J9) to Digital Input Control Card (J1)
( )	734B57-	Output Relay Card (J2) to CPU Card, Digital Mother Board, and Logic Power Supply
( )	734C81	RS-232-C Interface Card (J1) to Rear Panel Connector (J4)
( )	734C82-2	System Control Card (J3) to Rear Panel Connector (J3)
( )	734C83-	Rear Panel Connector (J2) to RAM Expansion Card
( )	734C88	TTY Interface Card (J1) to Rear Panel Connector (J4)
( )	734C99	Rear Panel Connector (J4) to CPU Card and RAM Expansion Card
( )	734C107	Digital Input Control Card (J1) to Rear Panel Connector (J3)
( )	734C109	Rear Panel Connector (J1) to Auxiliary Mother Board and Analog Input Mother Board
( )	734C141	Output Relay Card to Rear Panel Connector (J2)
( )	734C142-	Rear Panel Connector (J2) to CPU Card and RAM Expansion Card

EXTERNAL INTERCONNECTING CABLES

Qty.	E.A. Part Number	Description
( )	734C68-2	TTY Output ("Write" Only)
( )	734C86-1	RS-232-C Output
( )	734C86-2	RS-232-C and RS-366 Output
( )	734C89	Facit Output
( )	734C98	Mag Tape Output
( )	734C100-3	Battery Pack
( )	734C114	Texas Instrument (T.I. Output)

MISCELLANEOUS

Qty.	E.A. Part Number	Description
( )	734A36	36-Pin Blank Cover (Single)
( )	734A37	50-Pin Blank Cover (Single)
(1)	734A39	36-Pin Blank Cover (Double)
(1)	734A40	50-Pin Blank Cover (Double)
( )	734A56	Cable Connector ID

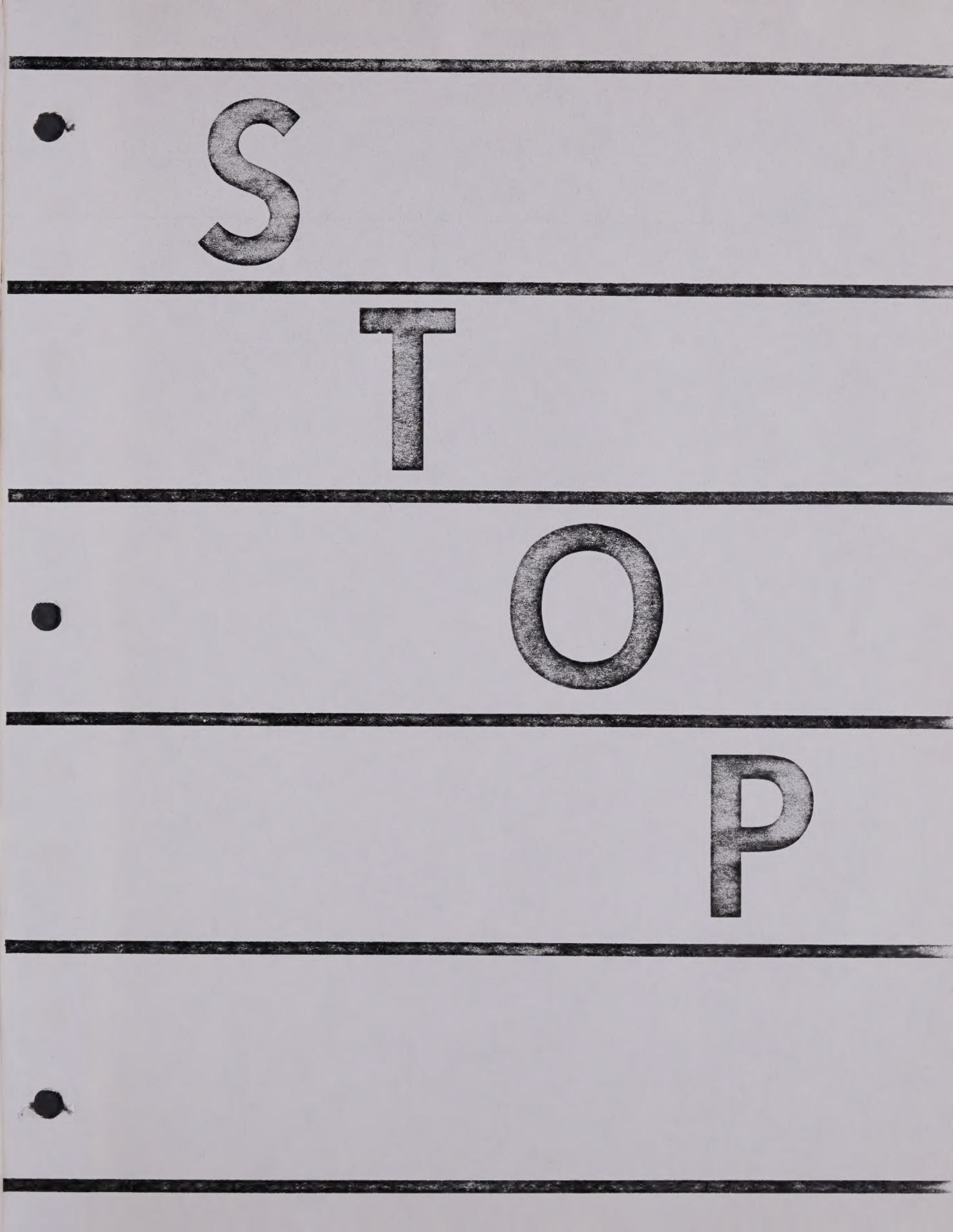
Qty.	E.A. Part Number	Description
( )	734A67	Connector Retainer Cover (Double)
( )	734A68	Connector Retainer Cover (Single)
( )	734A69	Screw Terminal Cover
( )	734A70	Channel No. ID (Screw Terminal)
( )	734B3-1	Top Connector Retainer (44-Pin)
( )	734B3-2	Bottom Connector Retainer (44-Pin)
( )	734B46-1	Top Connector Retainer (36-Pin)
( )	734B46-2	Bottom Connector Retainer (36-Pin)
( )	734B48-	Cable Connector ID
(1 ea	734B50-475	Channel No. or Assignable Setpoint No. ID (Solder Terminal)
( )	734B71-	36-Pin Connector ID
( )	734B72-	50-Pin Connector ID
( )	734C126	Screw Terminal Connector
( )	734C128	Screw Terminal Mtg. Cover
(1)	734D17-1	64-Channel TC Input Panel
( )	734D40-	32-Channel TC Input Panel
( )	91500-2	36-Pin Mating Connector
( )	KPC41	36-Pin Solder Terminal Connector
( )	KPC55	44-Pin Solder Terminal Connector
( )	KBR3-30500	50-Pin Mating Connector

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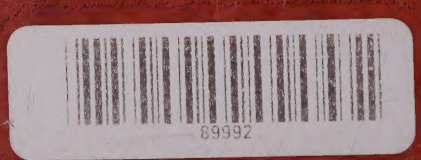

S
T
O
P

ACCOPRESS®

25071	BLACK
25072	LIGHT BLUE
25073	DARK BLUE
25074	LIGHT GRAY
25075	LIGHT GREEN
25076	DARK GREEN
25077	TANGERINE
25078	RED
25079	EXECUTIVE RED
25070	YELLOW

GENUINE PRESSBOARD

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CHICAGO, ILLINOIS 60618


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